RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Vol. 55 NOVEMBER, 1950 No. 5

CONTENTS

RADIOLOGY

A MONTHLY PUBLICATION DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

GENERAL INFORMATION

RADIOLOGY is entered as second class matter at Syracuse, New York, and Easton, Penna., under the Act of August 24, 1912, and accepted November 24, 1934. RADIOLOGY is published by the Radiological Society of North America as its official Journal. Subscription rate $8.00 per annum. Canadian postage, $1.00 additional. Foreign postage, $2.00 additional. Single copies $1.00 each. All correspondence relative to business matters connected with the Radiological Society of North America and RADIOLOGY, or remittance for non-member subscriptions, should be made payable to the Radiological Society of North America and should be addressed to the BUSINESS MANAGER, DONALD S. CHILDS, M.D., 713 E. GENESEE STREET, SYRACUSE 2, NEW YORK. In requesting change of address, both the old and the new address should be given.

Dues to the Radiological Society of North America include subscription to RADIOLOGY and should be paid to DONALD S. CHILDS, M.D., SECRETARY-TREASURER, 713 E. GENESEE STREET, SYRACUSE 2, N. Y.

The rate for "want" advertisements for insertion in the Classified Section is 8 cents per word, minimum charge $2.00. Remittance should accompany order. Rates for display advertisements will be furnished upon request.

Inquiries regarding the program for the Annual Meeting of the Society for the current year should be sent to the President.

RADIOLOGY is published under the supervision of the Publication Committee of the Radiological Society of North America, which reserves the right to reject any material submitted for publication, including advertisements. No responsibility is accepted by the Committee or the Editor for the opinions expressed by the contributors, but the right is reserved to introduce such changes as may be necessary to make the contributions conform to the editorial standards of RADIOLOGY. Correspondence relating to publication of papers should be addressed to the Editor, HOWARD P. DOUB, M.D., HENRY FORD HOSPITAL, DETROIT 2, MICHIGAN.

Original articles will be accepted only with the understanding that they are contributed solely to RADIOLOGY. Articles in foreign languages will be translated if they are acceptable. Manuscripts should be typewritten, double-spaced, with wide margins, on good paper, and the original, not a carbon copy, should be submitted. The author's full address should appear on the manuscript. It is advisable that a copy be retained for reference as manuscripts will not be returned.

Illustrations and tables should be kept within reasonable bounds, as the number which can be published without cost to the author is strictly limited. For excess figures and for illustrations in color, estimates will be furnished by the Editor. Photographic prints should be clear and distinct and on glossy paper. Drawings and charts should be in India ink on white or on blue-lined coordinate paper. Blueprints will not reproduce satisfactorily. All photographs and drawings should be numbered, the top should be indicated, and each should be accompanied by a legend with a corresponding number. Authors are requested to indicate on prints made from photomicrographs the different types of cells to which attention is directed, by drawing lines in India ink and writing in the margin. The lines will be reproduced, and the words will be set in type. Attention should be called to points which should be brought out in completed illustrations, by tracings and suitable texts. These instructions should be concise and clear.

As a convenience to contributors to RADIOLOGY who are unable to supply prints for their manuscripts, the Editor can arrange for intermediate prints from roentgenograms.

The Society will furnish fifty reprints to authors, for which arrangements must be made with the Editor.

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

Vol. 55 NOVEMBER 1950 No. 5

Primary Reticulum-Cell Sarcoma of Bone

Summary of 37 Cases[1]

BRADLEY L. COLEY, M.D., NORMAN L. HIGINBOTHAM, M.D., and HARVEY P. GROESBECK, M.D.[2]
New York, N. Y.

ONE OF THE earliest suggestions that reticulum-cell sarcoma could arise from the reticulo-endothelial structures of bone was made by Oberling (17) in 1928. In 1939, Ewing (13) accepted primary reticulum-cell sarcoma of bone as a distinct entity for inclusion in a revised classification of bone tumors for the Bone Sarcoma Registry of the American College of Surgeons. In the same year, Parker and Jackson (18) presented a complete study of 17 cases of this disease; 13 of the cases were from the Bone Sarcoma Registry material and the remainder from their personal experience. Since then only a few reports of small series of cases have appeared in the world literature (15, 19, 22, 23). In the majority of the more recently reported cases the disease was generalized, there were multiple bone foci, or histologic confirmation of the primary focus in bone was not obtained.

Definition: Primary reticulum-cell sarcoma of bone is a malignant tumor histologically identical with reticulum-cell sarcoma elsewhere in the body. It arises in a single focus in bone and is capable of regional and distant metastasis. It occurs most commonly in the earlier decades of life, is characteristically accompanied by a striking absence of general debility, and runs a relatively long natural course. The tumor is remarkably radiosensitive and exhibits a high degree of radiocurability.

Memorial Hospital Series: At Memorial Hospital (New York), since 1925, a clinical diagnosis of primary reticulum-cell sarcoma of bone has been made in 58 patients. In some of these cases the histologic interpretation of the pathologic material was in doubt; in others there was reason to question whether or not the bone lesion was metastatic from a general form of reticulum-cell lymphosarcoma. Accordingly, a set of criteria for inclusion in this series was adopted as follows:

(1) Clinically a primary focus in a single bone on admission.
(2) Unequivocal histologic proof[3] from the bone lesion (not from a metastasis).
(3) Metastases present on admission only if regional, or if the onset of symptoms of the primary tumor preceded the appearance of the metastases by at least six months.

Final analysis elicited a total of 37 cases which were acceptable under these criteria, and these form the basis for this study. The cases are summarized in Table I.

---

[1] From the Bone Tumor Service, Memorial Hospital, New York. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

[2] Formerly National Cancer Institute Trainee and Resident Surgeon, Memorial Hospital, New York.

[3] The authors are deeply indebted to Drs. Fred W. Stewart and Frank W. Foote, Jr., for their review of the microscopic sections of these cases.

TABLE I: PRIMARY RETICULUM-CELL SARCOMA OF BONE

Summary of 37 Cases: Memorial Hospital Series, 1925–1949

Case No.	Admission Date	Sex and Age	Bone	Treatment			Tumor Dose in Roentgens	Results			Remarks
				Surgery	Toxins	Radiation		Well	Died	Living with Disease	
1	6/27/25	M. 31	Tibia	Amputation	After recurrence	None	....	22 yr.	...	...	Stump recurrence, subcutaneous and node metastases controlled by toxins alone.
2	5/29/29	M. 14	Femur	.....	.....	Radium pack	....	...	2½ mo.	...	Extensive metastases to lung and skull on admission 7 months after onset of symptoms.
3	10/17/30	M. 53	Humerus	.....	1 course	X-ray	A. 4,080 r B. 1,240 r (18 mo.)	...	1 yr. 9 mo.	...	Metastases to liver, skull, brain, and ribs after 1 year. Died of tbc. hemoptysis. Primary N.E.D.*
4	4/29/32	M. 11	Scapula	.....	1 course	Radium pack	....	...	5 mo.	...	Fulminating generalized form of disease 11 months after onset.
5	10/31/34	M. 17	Tibia	.....	3 courses	X-ray	2,912 r	14 yr. 8 mo.	...	...	.....
6	5/3/35	M. 48	Ulna	Amputation 9 yr. later for local recurrence	3 courses	X-ray	4,470 r	...	...	13 yr. 6 mo.	Multiple bone metastases since 1945. Chordotomy for pain 1948.
7	10/2/35	M. 33	Ilium	.....	2 courses	X-ray and radium pack	Insufficient data	...	15 mo.	...	Metastases to femur and massive pelvic recurrence, 6 months after admission.
8	1/6/37	M. 14	Scapula	.....	3 courses	X-ray	A. 3,540 r B. 1,730 r (4 mo.)	12 yr. 8 mo.	...	...	.....
9	5/2/37	M. 55	Scapula	.....	.....	X-ray and radium pack	Insufficient data	...	11 mo.	...	Regional axillary and cervical node metastases on admission.
10	6/21/37	M. 47	Sternum	.....	3 courses	X-ray	A. 1,580 r B. 790 r (5 mo.)	...	11 yr. 3 mo.	...	Well for 10 years 8 months, until fulminating generalization. Primary N.E.D.*
11	3/28/38	M. 15	L-3 vertebra	.....	.....	X-ray	Insufficient data	...	17 mo.	...	Massive retroperitoneal extension.
12	6/24/38	M. 16	Femur	.....	2 courses	X-ray	2,190 r	11 yr	...	...	Metastasis to opposite tibia 10½ years later. Primary N.E.D.*
13	5/1/39	F. 19	Ulna	Amputation 10 yr. later for local recurrence	2 courses	X-ray	4,750 r	10 yr.	...	...	.....
14	1/8/40	F. 59	Ilium	.....	.....	X-ray and radium pack	Insufficient data	...	7 mo.	...	Massive tumor extending into buttock, thigh, and pelvis on admission.

						radium pack	data				buttock, thigh, and pelvis on admission.
15	10/15/40	M. 19	Tibia	Amputation	1 course	X-ray and P^{32} (3 mo. preop.)	2,950 r	...	...	8 yr. 6 mo.	Pulmonary metastases 8½ yr. after amputation.
16	6/18/41	F. 18	Femur	.....	.....	X-ray	3,700 r	7 yr. 7 mo.	...	...	.....
17	7/21/41	F. 27	Tibia	.....	.....	X-ray	4,225 r	6 yr 6 mo.	...	...	.....
18	9/18/41	F. 18	Humerus	.....	4 courses	X-ray	A. 4,350 r B. 2,975 r (8 mo.) C. 2,800 r (16 mo.)	...	1 yr. 7 mo.	...	Metastases to lung on admission 8 months after onset of symptoms and to skin and soft tissues 5 months after admission.
19	1/19/43	M. 63	Eighth rib	.....	.....	X-ray	3,550 r	6 yr. 4 mo.	...	...	.....
20	5/3/43	F. 13	Fibula	Resection of distal third	.....	X-ray (postop.)	3,730 r	5 yr 8 mo.	...	...	.....
21	4/25/44	M. 48	L-5 vertebra	.....	.....	X-ray	Insufficient data	5 yr. 1 mo.	...	...	.....
22	9/6/46	M. 54	Tibia	Amputation	.....	X-ray (1 mo. preop.)	1,715 r	2 yr. 8 mo.	...	...	No viable tumor in amputation specimen.
23	10/30/46	F. 21	Humerus	.....	1 course	X-ray	3,200 r	3 yr.	...	...	.....
24	2/18/47	F. 24	Femur	.....	2 courses	X-ray	A. 2,160 r B. 2,100 r (3 mo.)	2 yr. 4 mo.	...	...	Massive local tumor and regional groin metastases on admission. Now N.E.D.*
25	2/26/47	M. 37	Tibia	.....	.....	X-ray	3,300 r	2 yr. 6 mo.	...	...	.....
26	6/25/47	F. 25	Ilium	.....	3 courses	X-ray	3,125 r	...	2 yr 2 mo.	...	Metastases to lungs and subcutaneous tissue of back. Primary site N.E.D.*
27	9/4/47	M. 28	Tibia	.....	1 course	X-ray	Insufficient data	1 yr.	...	...	Regional groin metastases on admission.
28	10/29/47	F. 49	Femur	.....	1 course	X-ray	3,100 r	2 yr.	...	...	.....
29	11/4/47	F. 67	Femur	Amputation	.....	...	....	...	8 mo.	...	Fulminating metastases, retroperitoneal and cervical nodes, thyroid, 6 mo. postop.
30	2/2/48	M. 25	Femur	.....	2 courses	X-ray	2,625 r	1 yr. 2 mo.	...	...	Metastases to regional groin nodes on admission.
31	6/3/48	M. 33	Sternum	.....	1 course	X-ray	2,400 r	...	...	1 yr. 1 mo.	Metastasis to ilium 11 months after admission.
32	6/21/48	M. 18	Tibia	.....	1 course	X-ray	2,650 r	1 yr.	...	...	.....
33	7/2/48	F. 37	Femur	.....	1 course	X-ray	1,960 r	1 yr.	...	...	.....
34	1/27/49	F. 55	Fibula	Resection of proximal three-quarters	.....	X-ray (postop.)	....	8 mo.	...	...	.....
35	3/1/49	M. 57	Twelfth rib	Resection	1 course	X-ray (postop.)	....	1 yr. 1 mo.	...	...	Rib resected 11 months prior to admission.
36	3/28/49	M. 27	Tibia	.....	1 course	X-ray	....	...	...	Under treatment	Metastases to regional groin and iliac nodes on admission, 4 years after first symptoms.
37	4/7/49	M. 53	Ilium	.....	1 course	X-ray	2,750 r	...	6 mo.	...	Multiple bone and pulmonary metastases.

* N.E.D. No evidence of disease.

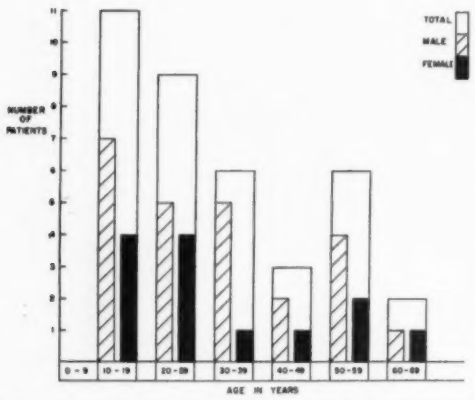


Chart I. Age and sex incidence in 37 cases of primary reticulum-cell sarcoma of bone (Memorial Hospital series, 1925–1949).

ETIOLOGY

General Incidence: Between the years 1925 and 1949 a total of 1,091 cases of malignant bone tumors of all types were seen in Memorial Hospital. Of these, 58 (5.3 per cent) were primary reticulum-cell sarcoma of bone. Vieta, Friedell and Craver (24) found the incidence of metastatic bone lesions in 213 cases of lymphosarcoma to be 7 per cent. On the other hand, Coles and Schulz (4) have reported an incidence of 32 per cent bone involvement in a series of 58 cases of reticulum-cell sarcoma.

Age and Sex Incidence: The combined age and sex incidence is summarized in Chart I. It will be seen that 24 patients were males and 13 were females, *i.e.*, approximately 2 males to 1 female.

Of particular interest and importance is the age incidence. The youngest of our patients was eleven years and the oldest sixty-seven years old, with an average of 33.7 years. Over one half of the patients were in the second and third decades of life and 70.3 per cent were under forty years of age. Parker and Jackson found that 77 per cent of their 17 patients were under the age of forty. A recent statistical review by Vieta, Friedell and Craver of 398 cases of the generalized form of lymphosarcoma at Memorial Hospital reveals a mean age incidence of forty-eight years, with the peak at fifty-two to fifty-six years. Thus it may be emphasized that there is considerable contrast in the age incidence between primary reticulum-cell sarcoma of bone and lymphosarcoma in general. Coley, Higinbotham and Bowden (7) have emphasized that the peak incidence of endothelioma of bone (Ewing's sarcoma) is in childhood and adolescence. In summary, primary reticulum-cell sarcoma of bone may occur at any age, but is usually found in the second, third, and fourth decades of life. This may frequently be of diagnostic import in distinguishing the disease from other bone tumors.

Other Etiologic Factors: The role of trauma in the etiology of malignant disease has been the subject of considerable discussion and is most difficult to evaluate with certainty (6). Most often the trauma merely serves to initiate or aggravate the symptoms of a tumor which is already well developed. In 20 of our cases no statement as to presence or absence of trauma was recorded; it was specifically denied in 2. In 15 cases a history of trauma was present, but in 11 of these the injury was either indefinite or occurred at the onset of symptoms referable to the primary condition. In the other 4 cases the trauma was definite and preceded the onset of symptoms by intervals of fifteen, sixteen, eighteen, and nineteen months. Further analysis of the information concerning these cases, however, fails in every instance to satisfy all the six postulates offered by Segond (20) in establishing trauma as an irrefutable etiologic factor. We are inclined therefore to question the possibility that it played any more than a coincidental role in the cases in our series.

As will be seen later, fever and local heat were present in only a few of our cases. Yet, in view of the fact that febrile response is not an unusual manifestation in lymphosarcoma in general, it would seem that the possibility of a specific infectious agent as an etiological factor in this disease should not be totally disregarded in the light of our present knowledge.

ANATOMIC SITE

As shown in Chart II, 24 of the 37 cases (65 per cent) occurred in long bones and, of these, 19 (79 per cent) were in the long bones of the lower extremities. This predilection for involvement of long bones is not present, on the other hand, in secondary bone involvement by lymphosarcoma. As pointed out by Jenkinson (14), the distribution of osseous metastases in lymphomas coincides quite closely with the sites of bone metastases from malignant tumors in general. This is distinctly not the case in the distribution of sites of origin of primary reticulum-cell sarcoma of bone, although, as we shall see later, metastases from this tumor do follow a similar pattern.

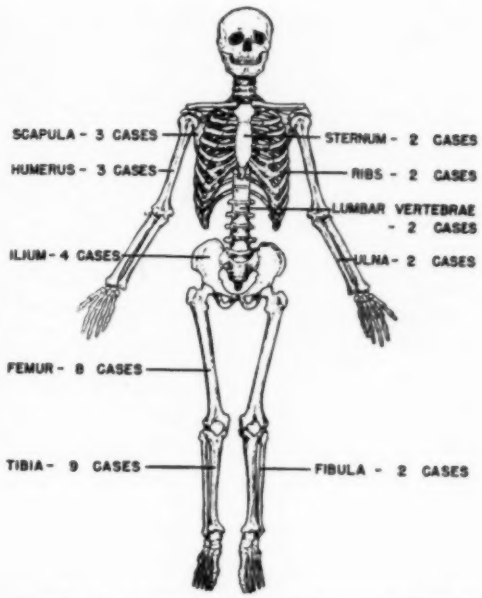


Chart II. Location of primary tumors in 37 cases of reticulum-cell sarcoma of bone.

PATHOLOGY

The pathologic features of primary reticulum-cell sarcoma have been discussed in detail by Parker and Jackson (18) and Edwards (12), and we shall therefore present here only a summary of the salient characteristics.

Gross Appearance: The tumor tissue encountered at biopsy or in the operative specimen is characteristically soft, friable, glistening fleshy material, occasionally homogeneous and frequently exhibiting areas of necrosis. The consistency varies from mushy and gelatinous to rubbery and firm. The color most frequently is grayish-pink, although in areas the tissue may be light yellow or even white. Erosion of marrow and cortex of the bone is a common feature, particularly as the disease progresses. A well developed pseudo-capsule was present in some of our cases, but more often the line of demarcation was ill-defined. After destruction of the cortex, the tumor extends into the contiguous soft tissues, where it may assume considerable proportions (Fig. 1B).

Histopathology: The microscopic appearance of primary reticulum-cell sarcoma of bone does not differ appreciably from that of reticulum-cell sarcoma appearing in lymph nodes or in viscera (Fig. 2B). The cells are usually quite evenly distributed and are notably larger than normal lymphocytes. The nuclei of the cells range in size from one and a half to three times that of the lymphocyte nuclei and vary from round or oval forms to those with indented, kidney-shaped contours. The cytoplasm is quite abundant, stains faintly, and may be either eosinophilic or basophilic.

A characteristic microscopic feature is the apparent ameboid activity of the cells as evidenced by the marked variations in shape. Some cells are round, others elongated and irregular, and others even exhibit pseudopod formation in both the nuclei and the cytoplasm. Although occasionally the cells may be binucleate, no true tumor giant cells of the Reed-Sternberg type are ever seen.

The stroma is fairly loose and moderately vascular, with collagen bundles varying from fine tendrils to dense bundles. Typically, the reticulum of this type of tumor not only surrounds groups of cells but also encases individual cells as fine threads of collagen fibers.

The growing tumor completely destroys and replaces the normal architecture of the

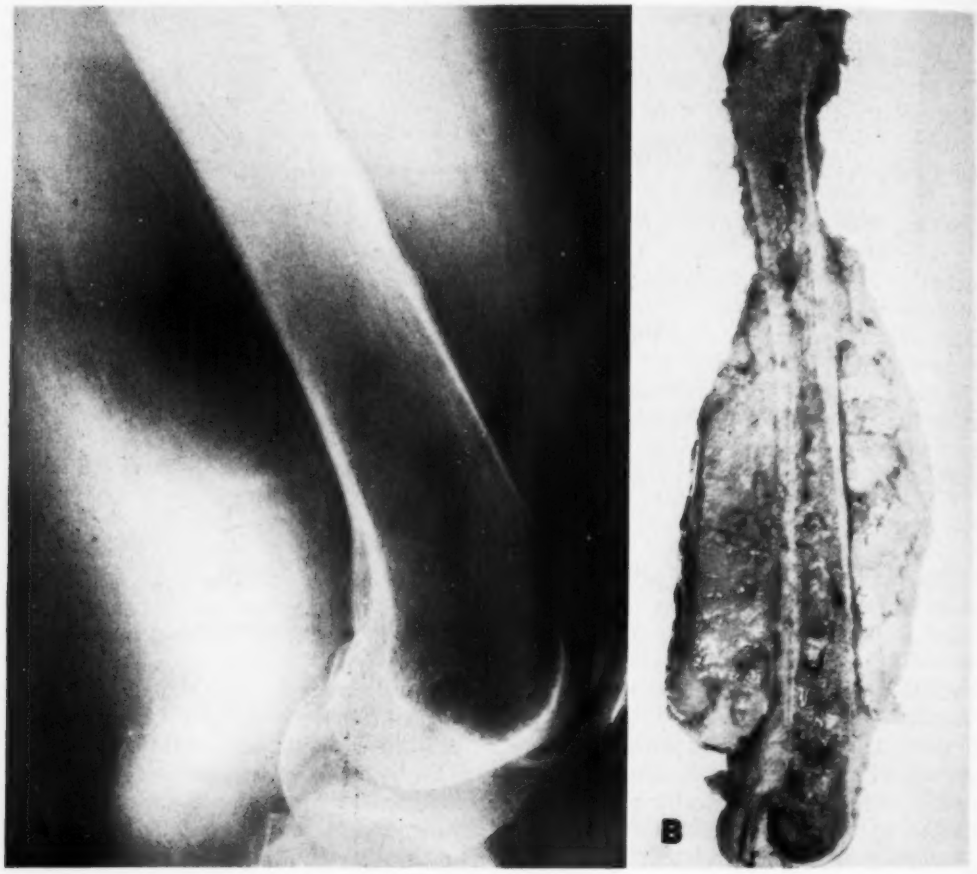


Fig. 1. Case 29.
A. Submitted roentgenogram showing moderate rarefaction in the lower end of the femur but not revealing the full extent of the growth.
B. Gross specimen after amputation, revealing extensive involvement of marrow and cortex and a large periosseous mass. Patient died of widespread metastases eight months after amputation.

bone marrow. Osteolysis of the cortex is a frequent feature and new bone formation, which appears to be a function of the stroma rather than the cells, may be seen often. Tumor cells are evident commonly in the walls of the smaller blood vessels, usually subendothelial in location, and may occlude the lumen to the extent of local infarct formation.

Blood Studies: The levels of the serum calcium, phosphorus, and alkaline phosphatase were recorded in 23 of 37 cases in our series. The calcium and phosphorus levels were within normal ranges in all of them. There was elevation above normal of the alkaline phosphatase in only 3 of the patients (Cases 6, 17, and 19). In one of these (Case 6), the elevation as high as 10.3 units (normal 1.5–5.0) may well be accounted for by the increased osteoblastic activity incident to the healing of a pathologic fracture. The level in Case 17 was only slightly elevated (6.4 units). In the third case, levels of 7.0 and 7.1 units returned to normal after radiation therapy. It may be assumed from these studies that, in the absence of a pathologic fracture, significant elevation of the phosphatase is not to be expected. These findings are in distinct contrast to the observations of

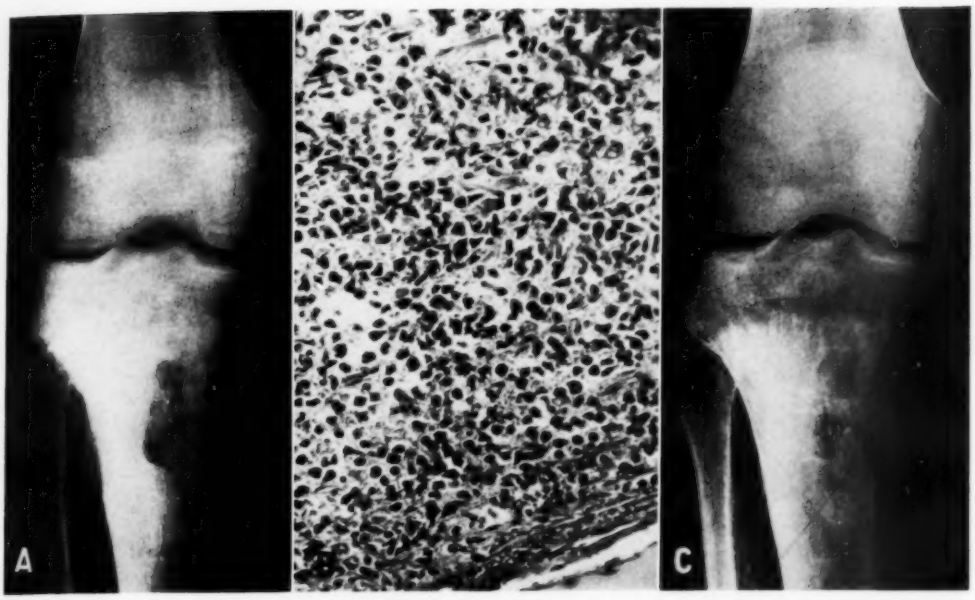


Fig. 2. Case 5.

A. Roentgenogram of tibia after biopsy but prior to therapy, showing patchy areas of destructive and productive changes and the biopsy defect.

B. Microscopic appearance of biopsy specimen: large nuclei of varying shapes, moderately abundant irregular cytoplasm, and relatively loose vascular stroma.

C. Appearance thirteen years after radiation therapy with a tumor dosage of 2,912 r and 3 courses of Coley's toxins. Patient is well fourteen and a half years after treatment.

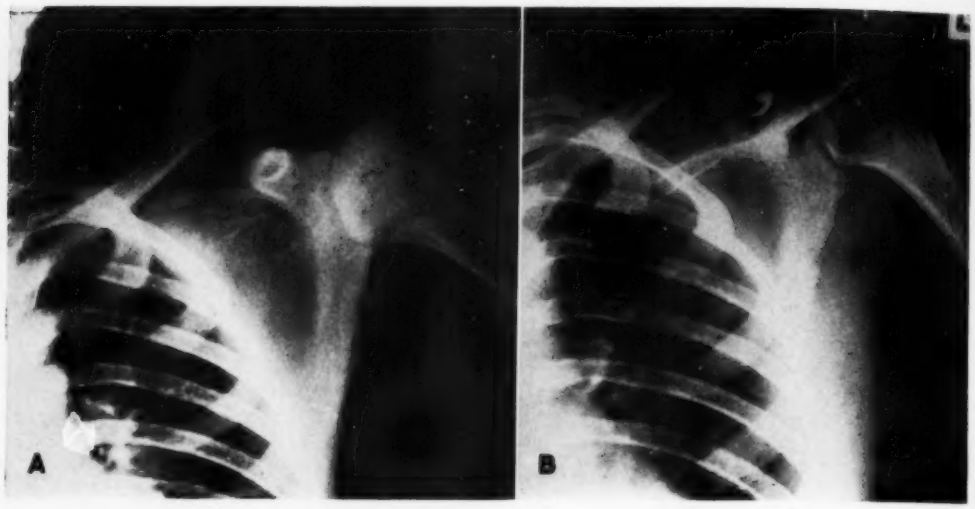
Woodard and Craver (25) in 17 cases of lymphosarcoma with metastatic bone involvement, in which the serum phosphatase was elevated in 8 cases (47 per cent).

Further peripheral blood studies in 29 of our cases revealed significant anemia in only 2 of our patients (Cases 19 and 21). There was elevation of the leukocyte count above 10,000 in only two instances. Absence of leukocytosis may be of value in ruling out osteomyelitis in the differential diagnosis.

SYMPTOMS

The symptoms associated with the onset and course of primary reticulum-cell sarcoma of bone are essentially those of any malignant tumor arising in bone. They consist chiefly of persistent pain, swelling, and subsequent disability as the disease progresses. Pain is usually the earliest symptom and this fact serves to emphasize that any persistent bone pain, particularly at rest, strongly suggests a malignant tumor; this assumption must be made until a thorough and complete investigation has unequivocally ruled out its possibility.

Pain: The most significant symptom is pain; it was present on admission in all of our patients. In 24 of the cases (65 per cent) pain alone was the presenting symptom; in all the other cases it was present in conjunction with other symptoms, usually swelling. The pain is typically intermittent during the initial phases of the disease, becoming constant only after the primary tumor has assumed considerable proportions, or in the event of a pathological fracture. The pain is frequently localized to the region of the involved bone, but it is significant that in 71 per cent of the cases involving long bones there was definite referral to the nearest joint. In several instances this fact contributed to delay in diagnosis, because the roentgenographic studies were limited to the painful area and the primary bone tumor was overlooked for long periods. The presence of



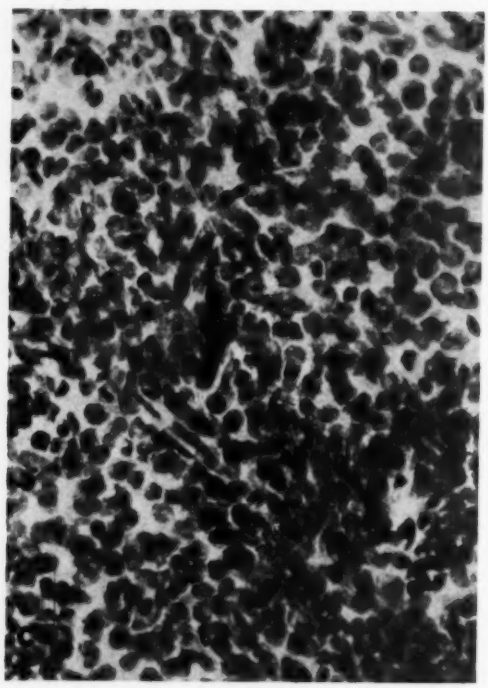


Fig. 3. Case 8.

A. Original roentgenogram showing diffuse destruction of the entire spine of the scapula.

B. Roentgenogram taken nine years after radiation therapy with 5,270 r tumor dose and 3 courses of Coley's toxins. Note complete healing of spine of scapula with scar bone. Patient is well twelve years after treatment.

C. Microscopic appearance of aspiration biopsy specimen. The same general characteristics are seen in this section as in Fig. 2B.

persistent nocturnal pain was specifically described in 9 of our cases and is, of course, characteristic of any malignant bone tumor. The pain was described as very severe in over one-half of the cases in this series, with only 10 patients evaluating their pain as mild. Thus, the disease may be described as causing early intermittent severe pain, frequently nocturnal and seldom relieved by rest, either localized over the involved bone or referred to the nearest joint, becoming constant and disabling as the disease progresses.

Swelling: Swelling was noticed by the patient at the onset of the disease in 13 instances in this study. The swelling was initially painless in only 5 of these cases, being coincident with pain in the other 8. Swelling in the soft tissues contiguous to the tumor, and occasionally in the neighboring joint, occurs as the disease progresses in most cases, as is illustrated by the fact that some degree of swelling was present in 31 (89 per cent) of our patients. It is not uncommon for the soft-tissue swelling to outgrow in size the tumor in the bone, reaching relatively enormous proportions (Fig. 1B).

Disability: Disability, most often associated with increase in pain with use, was specifically described in over one-half

of our cases; no mention of this symptom was made in the remainder of the records. In the absence of a pathologic fracture, disability results most often from pain associated with motion of the soft parts over the tumor, which leads the patient to favor the affected part; this, in turn, results in increasing impairment of function.

General Symptoms: The general well-being of patients with this disease, even in the face of extensive tumors, is frequently striking. In only 4 of our cases was weakness, anorexia, or fatigability noted, and in 2 of these significant weight loss and anemia were present. Weight loss was present to a substantial degree in 14 instances. A careful analysis of these cases failed to reveal any satisfactory correlation according to the size or location of the lesion, duration of symptoms, or other factors. It is our present opinion that the weight loss is most often a reflection of decrease in appetite, sleep, and activity coincident to the persistent pain and disability, rather than a specific metabolic alteration resulting from the presence of the growing tumor.

The remainder of the patients were described as being in good general state of health. One patient (Case 11) with extensive destruction of a lumbar vertebra had peripheral symptoms of nerve root pressure. Another patient had the unusual complaint of definite aggravation of the pain from the tumor, in the humerus, during menstruation.

Duration of Symptoms: It is of interest that the duration of symptoms, prior to definitive treatment, ranged from two months to over four years. Over 70 per cent of the patients had definite symptoms over six months, and more than 40 per cent had symptoms longer than one year prior to institution of suitable therapy. The role of delay in the establishment of a correct diagnosis in these time intervals will be discussed below.

PHYSICAL FINDINGS

The physical findings in this disease are limited to those associated with the primary tumor and any metastatic foci. Examination should include not only a detailed evaluation of the local findings of palpable tumor, changes in overlying skin, associated edema, tenderness, loss of function, and atrophy, but also a careful survey, particularly of the regional lymph node-bearing areas, to rule out the presence of regional or distant metastases.

Palpable Mass: Because of the presence of associated local edema, or disuse atrophy, the local tumor may not be apparent on cursory examination, but may require careful palpation with the muscles of the involved area in a neutral position of rest. A definite tumor was felt in 30 (81 per cent) of our cases; absence of a tumor was noted in 2 cases and in 5 no record was made on this point. The mass associated with a tumor in the shaft of a long bone is most commonly fusiform, while in flat bones or near a joint the mass is more frequently described as ovoid or ill-defined. The consistency of the palpable mass varies considerably. Many, particularly those with relatively rapid growth or extensive soft-tissue involvement, are soft and irregular. Those tumors in which the process is more closely confined to the site of origin in the bone vary from firm to bony hard in character. There is usually discernible attachment to the underlying bone, but occasionally the soft-tissue components are sufficiently large and pliable to present a misleading degree of mobility suggesting a tumor arising in the soft parts. This is illustrated by Case 29, in which there was a large movable mass, with minimal changes roentgenographically discernible in the bone. This led to a mistaken diagnosis of soft-part sarcoma (Fig. 1).

Tenderness: In 13 of our cases definite tenderness to palpation was present on admission. When the 8 patients who presented themselves with pathological fractures are excluded, however, one realizes that tenderness is not a usual feature of this disease. Other factors which play a role in producing tenderness are soft-tissue trauma from repeated contact with the

tumor during physical activity, recent biopsy, and unusually rapid growth of the tumor. The importance of a consideration of tenderness in this condition is that, when present, it may mislead the examiner into the belief that the lesion is on an inflammatory basis.

Local Heat: Significant increase of skin temperature in the region of the tumor was recorded in only 6 of our patients, in 3 of whom there was an unusually rapidly growing soft-tissue mass. Two of the others had had recent open biopsies in the area, and the sixth had fluid in and swelling around the neighboring joint. Thus, in this disease, local heat and redness are not characteristic except in some of those cases with an unusually rapid rate of growth of the soft-tissue components of the tumor.

Fever: Elevation of temperature above 99° was present in 7 patients and absent in 19; in 11 there was no record as to this feature. When the cases with recent biopsies, fungating tumors, or associated medical conditions are eliminated, this finding becomes relatively insignificant. This is in definite contrast to Ewing's sarcoma and even lymphosarcoma, in both of which a substantially higher incidence of fever has been reported (7, 10).

Pathological Fracture: Demonstrable fracture through the site of the primary neoplasm was present in 8 of the cases in this series. Six of the fractures were complete and in all but one there was a marked increase in disability. It is of interest that pathological fracture did not occur in any bone involved by metastatic tumor. Healing after adequate x-ray therapy was rapid, and no instance of fracture occurred after therapy was begun.

DIAGNOSIS

Careful evaluation of the clinical and roentgenographic features, when coupled with increasing experience with this disease, makes possible a correct provisional diagnosis in a larger number of cases than previously. It must be strongly emphasized, however, that the final diagnosis prior to therapy must always rest upon adequate histologic proof. The high degree of radioresponsiveness of this tumor is such that even a small amount of radiation therapy prior to biopsy may well obscure the histologic pattern sufficiently to render subsequent diagnosis impossible.

Biopsy: The use of aspiration or needle biopsy in the histologic diagnosis of malignant tumors has not gained universal acceptance but, when the experience of the surgeon and the pathologist is sufficient, the avoidance of morbidity and delay make the procedure worthy of consideration. Aspiration biopsy was performed in 14 of our cases (Fig. 3C). A definite diagnosis of reticulum-cell sarcoma of bone was possible in 7 cases; in 3 additional cases a diagnosis of malignant tumor was made and an open biopsy advised; in the remaining 4 patients the quantity of material was insufficient for reliable diagnosis and an open biopsy was performed.

In 27 of the cases in this series the definitive microscopic diagnosis was accomplished by open surgical biopsies, 18 of which were performed elsewhere, prior to admission to Memorial Hospital. In an additional 4 instances, final diagnosis was made from gross material after amputation or resection of the involved bone. The preferred technic for surgical biopsy is the same as for any malignant bone tumor, namely, direct approach, adequate section of material, with culture if inflammation is suspected, and careful closure of the wound in layers without drains or packing. Treatment should not be started until the final pathologic interpretation of the material is completed.

Roentgen Diagnosis: It is well agreed that there are no fully pathognomonic roentgen findings in this disease. A detailed study of the roentgenographic features of 17 cases of primary reticulum-cell sarcoma of bone, the majority of which are included in the present report, was recently made by Sherman and Snyder (21) at Memorial Hospital. They pointed out a number of features which, in combination, are highly characteristic of this condition.

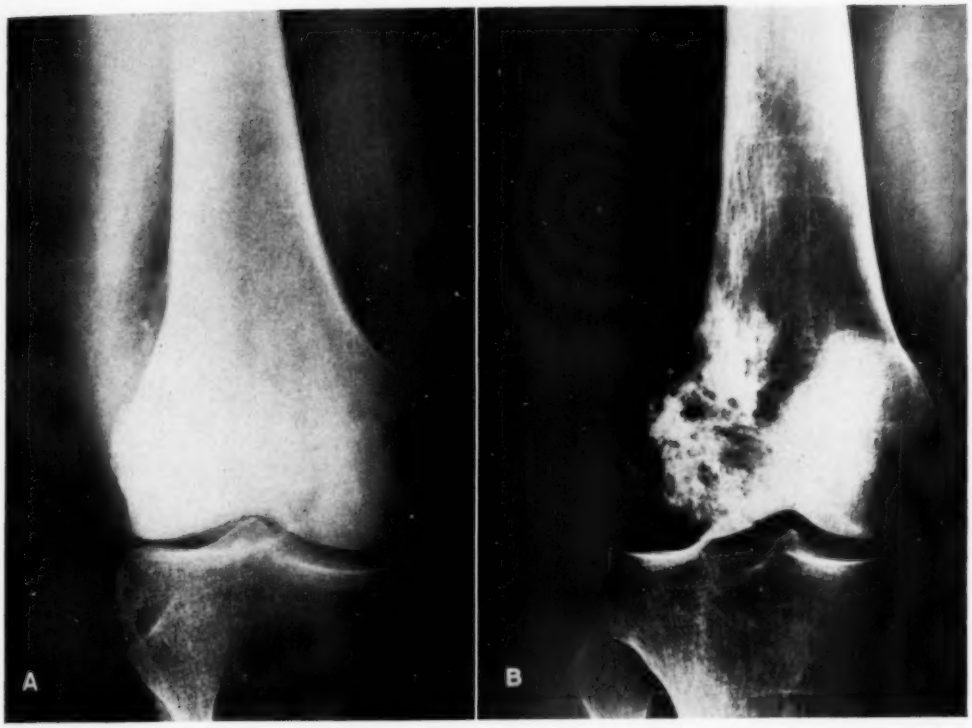


Fig. 4. Case 16.

A. Pre-treatment roentgenogram showing destructive lesion in distal femur, with areas of production, cortical destruction, periosteal reaction, and soft-tissue mass.

B. Appearance six years after radiation therapy with tumor dose of 3,700 r. Note typical scar type of bone healing. Patient is well after seven and a half years.

These will be merely summarized here, and the reader is referred to the original article for a more detailed study. Available films on an additional 13 of our cases, not included in the above study, have been reviewed, with a general pattern of roentgen features in agreement with the findings of Sherman and Snyder.

Primary reticulum-cell sarcoma almost invariably arises in the medullary portion of the bone (Fig. 2A), presenting a predominantly destructive, osteolytic picture (Fig. 3A), less prominent areas of productive change being exhibited in many of the tumors. This commonly results in a patchy distribution of areas of production interspersed with areas of destruction (Fig. 4A). The cortex is destroyed to varying degrees without expansion or thickening. Periosteal thickening may be observed in some cases, but is never a prominent feature and, when present, is usually of a thin, lamellated type. The direction of growth is predominantly within the bone, with some degree of extension into the soft tissues in most cases, occasionally exceeding in size the area of bone involvement. A highly characteristic, constant feature of reticulum-cell sarcoma of bone is the ill-defined boundary of the tumor both in the bone and the soft tissues (Fig. 5A). This is a most important consideration when the fields are being outlined for roentgen therapy. There is no highly characteristic location in bone which is of diagnostic import. The tumor occurs in any portion of the shaft of long bones and not uncommonly crosses the epiphyseal line. When the epiphysis is involved, the lesion is usually not confined to

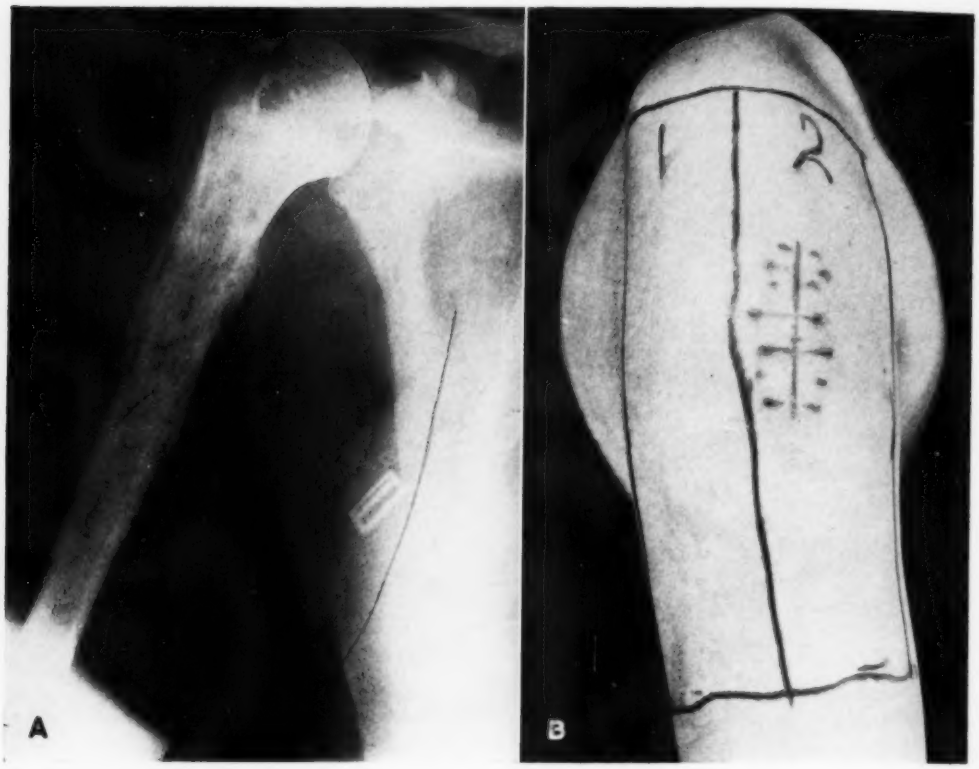


Fig. 5. Case 23.
A. Typical roentgenographic appearance of reticulum-cell sarcoma of bone in a 21-year-old woman.
B. Treatment ports outlined, through which a total tumor dose of 3,200 r was given. See also Fig. 5C.

that area. When the tumor involves bone near the joint, demonstrable synovitis is commonly present. The roentgenographic evidence of a high degree of response to irradiation is constant. Healing progresses, with disappearance of the soft-tissue mass, re-establishment of the cortex, and a replacement of the rarefied tumor with irregular linear areas of density which resemble scar bone (Figs. 2C, 3B, 4B, 5C).

DIFFERENTIAL DIAGNOSIS

From a clinical and roentgenologic point of view, osteogenic sarcoma presents the most common problem of differentiation, particularly when it is predominantly of the osteolytic type. A provisional diagnosis of osteogenic sarcoma was made, prior to biopsy, in 17 instances in our series. The frequency of prominent periosteal thickening and calcification of periosseous tumor masses, the lesser degree of cortical destruction and medullary growth, and the relative radioresistance of osteogenic sarcoma aid in distinguishing it from reticulum-cell sarcoma of bone. That there is seldom a problem microscopically is demonstrated by the fact that osteogenic sarcoma was suggested from biopsy in only 1 of our cases.

There is still considerable discussion among pathologists concerning the differentiation of Ewing's sarcoma and primary reticulum-cell sarcoma histologically. In fact, biopsies were originally interpreted as showing Ewing's sarcoma in 7 of our cases. When reticulum-cell sarcoma involves the shaft, there may also be considerable roentgenographic similarity be-

tween these two tumors. However, the definitely younger age group, frequency of pulmonary metastases, the rapidly progressive course, the lesser degree of radiocurability, and the constant occurrence of prominent periosteal reaction in Ewing's sarcoma combine to afford considerable differentiating aid.

In 7 of our cases, chiefly earlier ones, a mistaken clinical and roentgenographic diagnosis of osteomyelitis was made. The concomitant signs in osteomyelitis, of fever, presence of bacterial growth on cultures, response to antibiotics, and histologic differences, have reduced this error in recent years.

Carcinoma metastasis to bone may occasionally simulate reticulum-cell sarcoma, as it did on 3 occasions in our patients. In metastatic cancer, however, cortical destruction is less frequent, patchy destruction and production are seldom present, and a primary source is usually discoverable.

Other conditions which had been suggested at some time in the course of our cases include eosinophilic granuloma, osteoid osteoma, synovioma, metastatic neuroblastoma, angiosarcoma, malignant giant-cell tumor, myeloma, Paget's disease of bone, bursitis, synovitis, and even "arthritis." In all of these, the confusion was clarified after adequate biopsy.

The assurance that primary reticulum-cell sarcoma of bone is not in reality a secondary manifestation of lymphosarcoma arising elsewhere may occasionally be difficult to obtain. The combined factors of absence of other bone foci, the common difference in age, the presence of bone involvement for substantial intervals prior to the demonstration of any but regional metastatic foci, and the long periods of control after irradiation, are all of value in distinguishing between the two distinct forms of the disease. It is significant that in lymphosarcoma secondary bone involvement is usually of late occurrence and the course thereafter is most often one of rapid progression. Vieta, Friedell and Craver found that bone involvement by lymphosarcoma occurred in the final third of the course of the disease in 63 per cent of their cases and that, after the onset of bone lesions, the average survival was 5.8 months.

Fig. 5C. Case 23: Appearance two years after treatment with high-voltage roentgen rays and one course of Coley's toxins.

Delay in Diagnosis: A study of the time elapsed between the initial medical consultation and the establishment of the definitive diagnosis in our cases is worthy of comment. A period of over three months was present in 23 instances and over six

months elapsed in 15 of these cases, with isolated examples of delay in excess of two years. An analysis of a number of the histories reveals several factors operative in such culpability. The relatively slow course of these bone tumors occasioned a negative roentgen picture in a few of the patients, including those with referred joint pain in whom films were taken of the joint only. In some cases the symptoms were sufficiently mild and intermittent to fail to impress the physician with the possibility of a malignant tumor. Other patients were treated for long periods for an erroneously diagnosed benign neuromuscular disorder. Finally, some of the delay appeared to be ascribable to the failure of the physician to obtain a biopsy of the primary lesion even though a tumor was suggested roentgenographically and clinically. The importance of early diagnosis in this tumor cannot be overemphasized, particularly since, as will be seen below, the prognosis is so good in those cases which are adequately treated prior to the occurrence of metastatic foci.

METASTASES

Metastases were present in 18 cases, 48.7 per cent of the series. Many cases had more than one metastatic focus. The sites were as follows:

Other bones (13 metastases)	
Ribs	3
Skull	2
Scapula	2
Vertebra	2
Femur	1
Tibia	1
Ilium	1
Sacrum	1
Soft parts (26 metastases)	
Regional lymph nodes only	5
Other lymph nodes	6
Subcutaneous tissues	5
Lungs	3
Brain	2
Liver	1
Thyroid	1
Skin	1
Fulminating generalization	2

It is striking that in the cases with spread of the disease elsewhere in the body, this was evident in the great majority at the time of admission or within one year thereafter. In only 3 instances was the interval longer than one year, and in all of these the metastases appeared after remarkably long periods—ten or more years—following permanent control of the primary lesion. In Case 12 a single bone metastasis developed after ten years; Case 10 exhibited a fulminating form of generalization after almost eleven years of control, and Case 6 showed multiple metastases one year after a local recurrence appearing nine years following treatment. In most of the other cases with metastases after admission, there was ample evidence that there had been failure to control the primary tumor prior to the spread of the disease.

Regional Metastases: Metastases to the regional lymph nodes alone occurred in 5 of our cases. In 4 of these patients no other type of metastasis has become evident since adequate therapy six months to two and a half years previously. The other tumor was treated only palliatively and a pulmonary metastasis was manifest ten months later.

Distant Metastases: An analysis of the sites of metastases other than lymph nodes reveals a propensity for the flat bones, subcutaneous tissues, lungs, and brain in that order of frequency. It is of significance, we believe, that only one probable distant metastasis occurred after definite clinical control of the primary lesion; that was a cortical metastasis to a contralateral bone occurring ten years after therapy (Case 12). Because of the predominantly cortical position of this lesion, we are assuming it to be a metastasis, although the possibility of a new osseous primary tumor cannot be ruled out. It is of interest that one of Parker and Jackson's 17 cases presented a very similar sequence of events, with a second bone focus occurring twelve years after treatment of the primary; in this instance the treatment was amputation only. The majority of bone metastases are more predominantly destructive in nature and may be primarily cortical in their apparent site of origin.

Generalized Metastasis: Fulminating generalization of the reticulum-cell sarcoma was observed in only 2 of our patients, which is in contrast to the common variety of lymphosarcoma. In 1 case this occurred five months after palliative radium pack therapy was begun (Case 4). The other case is of considerable interest inasmuch as the general spread occurred almost eleven years after clinically complete control of the primary focus in the sternum (Case 10). Whether or not this represents a flare-up of a quiescent focus elsewhere in the body or an entirely new lymphomatous process in a patient with a propensity for this type of neoplasm is open to speculation. We are inclined to favor the former hypothesis.

TREATMENT

It is apparent that primary reticulum-cell sarcoma of bone is highly radiosensitive. As our experience with this disease has increased, it has been increasingly evident that there is a high degree of radiocurability as well. Accordingly, the primary definitive therapy in the majority of our cases has been roentgen therapy. This is in contrast to the published opinion of Parker and Jackson who, on the basis of their 17 collected cases, stated that amputation followed by irradiation of the local and regional areas was the treatment of choice. After an analysis of our end-results, however, we remain of the opinion that carefully administered roentgen therapy, with the complementary administration of Coley's toxins (the mixed toxins of erysipelas and *Bacillus prodigiosus*, Shear's filtrate, etc.), offers the best chance of control of this disease.

Roentgen Therapy: Twenty-seven of our cases received definitive deep roentgen therapy. In general, the treatment was given through two or more portals, cross-firing the region of the primary tumor (Fig. 5B). In patients treated prior to 1939 the usual factors of irradiation were 200 kv., 0.5 mm. Cu filter, and 50 cm. target-skin distance. Subsequent to 1939 the factors were commonly 250 kv., 1.5 mm. Al filter, and 50 cm. target-skin distance. One patient (Case 13) was treated elsewhere with irradiation generated at 160 kv., 0.5 mm. Cu and 1.0 mm. Al filtration, 50 cm. distance.

An analysis of the calculated tumor doses reveals considerable variation in total dose, but it becomes apparent that control of the primary tumor is possible with unusually low tumor depth doses, even in the neighborhood of 2,000 r (see Cases 10 and 12). It is to be noted that, in each of these cases, with a small tumor dosage, there occurred a ten-year period of control with subsequent metastases. In Case 22 a total of only 1,715 r was given, and at amputation, one month later, there was no histologic evidence of viable tumor. While this does not necessarily indicate that a permanent radiotherapeutic control would have ensued, it is nevertheless impressive evidence of the remarkable response to relatively small amounts of radiation. On the basis of the majority of our series, however, we believe that a calculated tumor dose of at least 3,000 r is optimum for the average case. Of those patients without metastases who received over 3,000 r to the tumor, only 1 (Case 6) exhibited a definite local recurrence. Serial films on this patient present strong evidence that the site of recurrence was immediately outside of the area of primary irradiation.

Radium element pack therapy was administered in 5 of the earlier patients, both alone and in conjunction with deep roentgen therapy. A study of these cases reveals that the treatment may rightfully be considered to have been palliative in all, and we are therefore not prepared to evaluate the effectiveness of this modality in reticulum-cell sarcoma of bone. One patient (Case 15) received radioactive phosphorus (P^{32}) concomitantly with roentgen therapy without demonstrable effect specifically ascribable to that element.

Surgery: Surgery was utilized in the treatment of 9 of our cases. In 2 of them (Cases 1 and 29) amputation without

roentgen therapy was done. In each of these multiple metastases developed promptly. Case 1 was subsequently treated successfully by Coley's toxins only (see below). In Case 29, in which a hip joint disarticulation was done on a mistaken diagnosis of soft-tissue sarcoma, the metastases were of a fulminating form, with death eight months after treatment in spite of palliative roentgen therapy to some of the secondary lesions.

In Cases 15 and 22 preoperative roentgen therapy was given, followed by low thigh amputation three months and one month, respectively, after irradiation. Histologic study of both specimens revealed markedly altered, "probably nonviable," tumor cells. Resection of the tumor-bearing portion of the fibula was done in Cases 20 and 34, with heavy postoperative roentgen therapy; resection of the involved rib was performed in Case 35 followed by irradiation. In all 3 of these cases the resection was done for the combined purpose of adequate biopsy and as the elective treatment. Control of the disease has been complete, to date, in all three instances.

In Cases 6 and 13, amputation was done for locally recurrent sarcoma nine and ten years, respectively, after irradiation was completed. One of these patients (Case 6) is still living, with multiple metastases, four years after the amputation and thirteen years subsequent to the initial therapy. In Case 13 amputation was done only recently.

In summary, we do not believe that we have sufficient evidence to support the belief that surgery, either alone or in conjunction with irradiation, offers a sufficiently greater chance of survival to justify the disability incident to the amputation. We have no objection to the performance of non-disabling resections of such bones as the fibula and ribs, combined with adequate postoperative roentgen therapy. At present, however, our series of such cases is of insufficient size and duration to demonstrate any increased salvage with this procedure.

Coley's Toxins: Twenty-two of our cases received one or more courses of Coley's toxins. The route of administration is usually intramuscular or intravenous, beginning with a fraction of a minim and increasing the dose according to the individual febrile response of the patient. A usual course consists of ten to fourteen injections and may be repeated as indicated.

The most dramatic response to Coley's toxins occurred in Case 1 (Bone Sarcoma Registry No. 1143), which has been thoroughly documented elsewhere in the literature (2, 3, 5, 8, 9, 16). Briefly, the patient had a mid-thigh amputation in 1925 for a malignant tumor of the tibia originally diagnosed as "endothelioma" and recently reviewed as reticulum-cell sarcoma. There developed histologically proved early recurrence in the stump and multiple metastases in the regional lymph nodes, periumbilical tissues, scalp, clavicle, and cervical vertebrae. The sole treatment subsequent to the amputation was several courses of Coley's toxins given both intramuscularly and intratumorally in large doses over a total period of eleven months, with rest periods of a few weeks between courses. All of the metastatic areas completely disappeared and the patient has remained in good health, free of recurrent disease, twenty-one years since that time.

In the remaining patients, Coley's toxins were given in conjunction with roentgen therapy. Of 13 patients in this series who survived more than five years after treatment, 8 received Coley's toxins in one or more courses, and 5 patients did not receive toxins as a part of their definitive treatment. Although an objective evaluation of the effectiveness of toxins is difficult to achieve under these circumstances, it is our opinion that their use concomitantly with roentgen therapy is definitely indicated in reticulum-cell sarcoma of bone.

Treatment of Metastases: Accessible metastases respond readily to roentgen therapy, particularly regional lymph-node metastases or a well localized focus such as

was encountered in Case 12. In this patient a single metastatic area in the opposite tibia was heavily irradiated, with complete clinical subsidence. When the metastases assume massive size, are generalized, or relatively inaccessible to adequate dosages of irradiation, little more than transient palliation may be expected.

END RESULTS

Twenty-one of the patients in this series were treated prior to July 1944 and thus are eligible for inclusion in five-year survival studies. Thirteen of these cases are suitable for ten-year end-result analysis. The survival data in these categories are presented in Table II.

TABLE II: END-RESULTS OF TREATMENT IN PRIMARY RETICULUM-CELL SARCOMA OF BONE

Memorial Hospital Series 1925–1944

Five Year End-Results		
Total number of patients		21
Indeterminate group (dead as a result of other causes and without recurrence, or lost track of without recurrence)		0
Determinate group		21
Failures:		
Dead as a result of reticulum-cell sarcoma	9	
Lost track of with disease (probably dead)	0	
Living with recurrence	2	
Total number of failures in treatment		11
Successful results: Free from disease after five years or more		10
Net five-year end-results: Successful results divided by determinate group (10/21)		47.6%
Ten Year End-Results		
Total number of patients		13
Indeterminate group (dead as a result of other causes and without recurrence or lost track of without recurrence)		0
Determinate group		13
Failures:		
Dead as a result of reticulum-cell sarcoma	7	
Lost track of with disease (probably dead)	0	
Living with recurrence	1	
Total number of failures in treatment		8
Successful results: Free from disease after ten years or more		5
Net ten-year end-results: Successful results divided by determinate group (5/13)		38.4%

The fact that in 3 of our patients recurrences developed nine to eleven years after treatment, and that in 3 instances, metastases became evident over ten years after therapy, serves to emphasize that five-year end-result figures are of only relative value in any study of this disease.

It is of interest that, if those cases in which the therapy was distinctly palliative are eliminated from the series, the five-year survival rate is 73.3 per cent and the ten-year rate 55.5 per cent. These figures further illustrate the relatively high degree of radiocurability in those patients in whom clinically discernible distant metastases have not occurred prior to therapy.

SUMMARY

A study of 37 cases of primary reticulum-cell sarcoma of bone has been made, and the clinical, diagnostic, and therapeutic aspects of the disease are reviewed.

The disease is most common in males. It may occur at any age, but almost three-fourths of this series occurred in the second, third, and fourth decades. Typically the course is more benign than that of any other malignant tumor of bone, and the lack of debility in most of our patients is a striking feature.

The treatment of choice in primary reticulum-cell sarcoma is carefully administered roentgen therapy, in amounts sufficient to give an estimated tumor depth dose of 3,000 to 4,000 r.

Metastasis and recurrence may occur as late as ten or more years after therapy. Many of these metastatic and recurrent lesions may be further controlled by radiation therapy or surgery.

Memorial Hospital
New York 21, N. Y.

BIBLIOGRAPHY

1. SIMMONS, C. C.: Bone Sarcoma; Factors Influencing Prognosis. Surg., Gynec. & Obst. **68:** 67–75, January 1939.

2. CHRISTIAN, S. L., AND PALMER, L. A.: Apparent Recovery from Multiple Sarcomata. Mil. Surgeon **61:** 42–47, July 1927.

3. CHRISTIAN, S. L., AND PALMER, L. A.: Apparent Recovery from Multiple Sarcoma with Involvement of Both Bone and Soft Parts Treated by Toxins of Erysipelas and Bacillus prodigiosus (Coley). Am. J. Surg. **4:** 188–197, February 1928.

4. COLES, W. C., AND SCHULZ, M. D.: Bone Involvement in Malignant Lymphoma. Radiology **50:** 458–462, April 1948.

5. COLEY, B. L.: Neoplasms of Bone and Related Conditions. New York, Paul B. Hoeber, Inc., 1949, p. 338.

6. COLEY, B. L.: Trauma in Malignant Tumors of Bone. Am. J. Surg. **73:** 300–304, February 1947.

7. COLEY, B. L., HIGINBOTHAM, N. L., AND BOWDEN, L.: Endothelioma of Bone (Ewing's Sarcoma). Ann. Surg. **128:** 533–560, September 1948.
8. COLEY, W. B.: Discussion of case presented by H. Lilienthal, New York Surg. Soc. Tr., in Ann. Surg. **85:** 615–624, April 1927.
9. COLEY, W. B.: Diagnosis and Treatment of Bone Sarcoma. Glasgow M. J. **126:** 128–161, September 1936.
10. CRAVER, L. F.: Lymphomas and Leukemias. Bull. New York Acad. Med. **23:** 79–100, February 1947.
11. CRAVER, L. F., AND COPELAND, M. M.: Lymphosarcoma in Bone. Arch. Surg. **28:** 809–824, May 1934.
12. EDWARDS, J. E.: Primary Reticulum Cell Sarcoma of the Spine. Am. J. Path. **16:** 835–844, November 1940.
13. EWING, J.: A Review of the Classification of Bone Tumors. Surg., Gynec. & Obst. **68:** 971–976, May 1939.
14. JENKINSON, E. L.: Hodgkin's Disease. Radiology **19:** 41–47, July 1932.
15. KHANOLKAR, V. R.: Reticulum Cell Sarcoma of Bone. Arch. Path. **46:** 467–476, November 1948.
16. MEYER, W.: Cancer. New York, Paul B. Hoeber, Inc., 1931, pp. 347–349.
17. OBERLING, C.: Les réticulosarcomes et les réticulo-endothéliosarcomes de la moelle osseuse (sarcomes d'Ewing). Bull. de l'Assoc. franç. p. l'étude du cancer **17:** 259–296, May 1928.
18. PARKER, F., JR., AND JACKSON, H., JR.: Primary Reticulum Cell Sarcoma of Bone. Surg., Gynec. & Obst. **68:** 45–53, January 1939.
19. ROSENDAL, T.: On Reticulosarcoma in the Bones. Acta. radiol. **26:** 210–221, 1945.
20. SEGOND, P.: Assoc. franç. d. chir. **20:** 745, 1907. Cited by Coley, W. B., and Higinbotham, N. L.: Injury as a Causative Factor in the Development of Malignant Tumors. Ann. Surg. **98:** 991–1012, December 1933.
21. SHERMAN, R. S., AND SNYDER, R. E.: Roentgen Appearance of Primary Reticulum Cell Sarcoma of Bone. Am. J. Roentgenol. **58:** 291–306, September 1947.
22. SZUTU, C., AND HSIEH, C. K.: Primary Reticulum Cell Sarcoma of Bone. Ann. Surg. **115:** 280–291, February 1942.
23. UEHLINGER, E., BOTSZTEJN, C., AND SCHINZ, H. R.: Ewing's Sarkom und Knochenretikulosarkom. Klinik, Diagnose und Differentialdiagnose. Oncologia **1:** 193–245, 1948.
24. VIETA, J. O., FRIEDELL, H. L., AND CRAVER, L. F.: A Survey of Hodgkin's Disease and Lymphosarcoma in Bone. Radiology **39:** 1–14, July 1942.
25. WOODARD, H. Q., AND CRAVER, L. F.: Serum Phosphatase in Lymphomatoid Diseases. J. Clin. Investigation **19:** 1–7, Janury 1940.

SUMARIO

Sarcoma Reticulocelular Primario de los Huesos

En este estudio de 37 casos de sarcoma reticulocelular de los huesos, observados en el Memorial Hospital (Nueva York), repásanse las fases clínicas, diagnósticas y terapéuticas de la dolencia.

El sarcoma reticulocelular primario de los huesos es más frecuente en los varones. Puede presentarse a cualquier edad, pero casi tres cuartas partes de los enfermos de la serie aquí descrita se hallaban en el segundo, tercero y cuarto decenios de la vida.

Típicamente, la evolución es más benigna que la de ningún otro tumor benigno de los huesos, siendo una característica notable la falta de debilidad en la mayoría de los pacientes. En la iniciación, los síntomas sobresalientes consisten en dolor y edema, con incapacidad a medida que avanza la afección.

Clínica y roentgenológicamente, el sarcoma osteógeno es el que más a menudo plantea problemas en el diagnóstico diferencial. En 17 casos de esta serie, hízose un diagnóstico provisorio de sarcoma osteógeno antes de la biopsia, pero sólo en un caso lo sugirió el cuadro microscópico.

El tratamiento de elección es la roentgenoterapia en cantidades suficientes para suministrar una dosis tumor profunda calculada en 3,000 a 4,000 r.

Metástasis y recurrencias pueden sobrevenir hasta diez o más años después de la terapéutica, pero muchas de esas lesiones recurrentes y metastáticas responden favorablemente a la radioterapia o la cirugía.

Significance of Intracranial Calcification in the Roentgenologic Diagnosis of Intracranial Neoplasms[1]

JOHN D. CAMP, M.D.

Rochester, Minn.

IN THESE DAYS OF specialized procedures which may facilitate a precise localization of mass lesions of the brain, one must not overlook the fact that ordinary roentgenography of the skull, when used intelligently and as the patient's symptoms may indicate, will reveal with considerable accuracy the site and frequently the type of an intracranial lesion.

Calcification within a lesion is the most significant roentgenologic sign of intracranial disease. Not only does the position of the calcium shadows localize the lesion, but not infrequently the arrangement of the calcium deposits will enable a prediction of the probable histologic character of the mass.

Since non-neoplastic as well as neoplastic lesions may exhibit roentgenographic evidence of calcification, and inasmuch as the roentgenographic characteristics of such calcification are now well established, the experienced radiologist on his preliminary examination frequently can identify non-neoplastic lesions that may be producing symptoms which imitate those of a brain tumor. Even though calcification may not be exhibited by a cerebral neoplasm, roentgenographic evidence of its presence and situation may often be disclosed by displacement of the shadow of a calcified pineal body.

TECHNIC

For the delineation of the fine shadows of calcification associated with many intracranial lesions, roentgenograms that reveal a proper amount of contrast, a lack of motion, and clear detail are necessary. The standard positions for examination of the skull are well known, and those best calculated to reveal the suspected site of the lesion should be used. The minimal routine for examination of the skull should include exposures in the lateral, postero-anterior and the Towne projections. The lateral roentgenograms should be made stereoscopically. Special positions, including tangential projections, may be helpful in many cases. It is important that extracranial shadows resulting from lesions or objects in the scalp or hair should not be mistaken for evidence of intracranial disease. Even stereoscopy may be misleading if roentgenograms are not placed in proper register, and the experienced roentgenologist invariably will check the site of a suspected calcified lesion by observing the shadow in two planes. Rubber bands on locks of hair, braids, certain hair-dressing materials, and especially dried blood in the hair may cast shadows of increased density which, under the right conditions, will imitate intracranial calcification. Opaque materials are frequently used in the manufacture of veils, transformations, and toupees, and these objects should be removed before the examination. Shadows of calcification in the scalp, especially if multiple, may also be deceiving.

PINEAL CALCIFICATION

Varying degrees of calcification of the pineal body may normally be observed in roentgenograms of 60 per cent of persons more than twenty years of age (1). Roentgenologic evidence of pineal calcification is rare under ten years of age, and when present should suggest a pinealoma. The incidence of calcification in this tumor for

---

[1] From the Section on Roentgenology, Mayo Clinic, Rochester, Minn. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

The discussion of this paper is included in the discussion of the symposium of which it was a part, in the September issue of RADIOLOGY (p. 357).

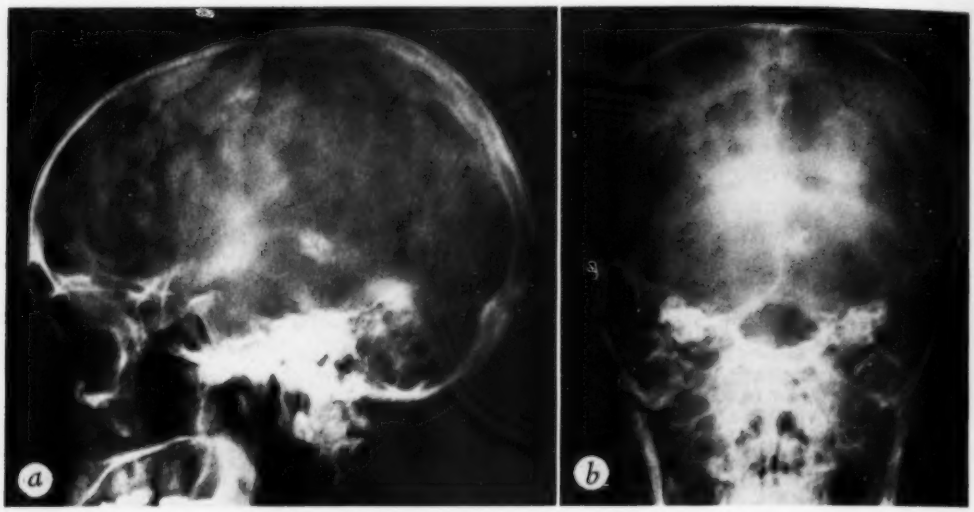


Fig. 1. Pinealoma. *a*. Lateral view of skull revealing an abnormal amount of calcification within the pineal body. *b*. Towne projection revealing calcification in pinealoma. The calcium mass is displaced slightly laterally, due to non-calcified portion of tumor.

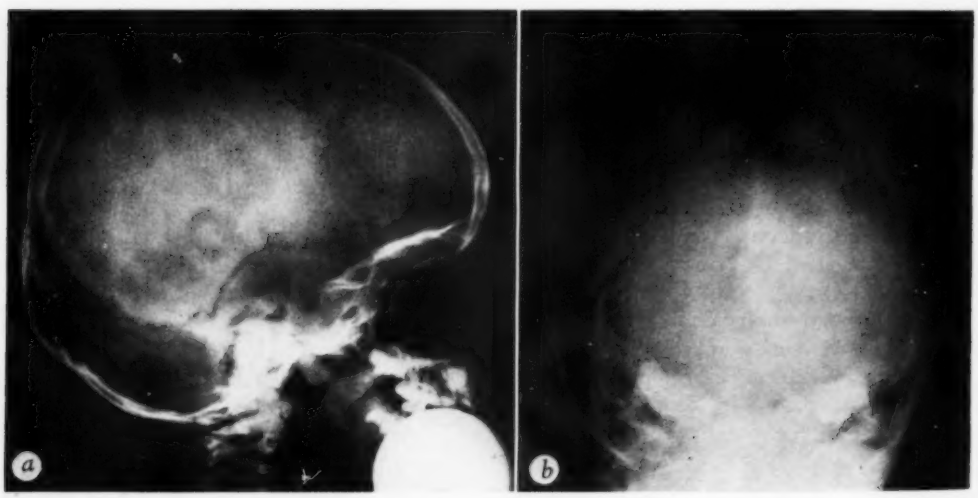


Fig. 2. Pineal teratoma. *a*. Lateral view of skull revealing shadows of calcium and bone within the region of the pineal body. These shadows are surrounded by a shadow of diminished density, which represents the surrounding fat in the tumor. *b*. Towne projection revealing position of pineal teratoma within the mid-line and central shadows of calcium and bone surrounded by fatty portion of tumor.

all age groups is about 20 per cent, but it is higher in children; in Baggenstoss and Love's series (2), it was observed in 50 per cent of the cases. Large amounts of calcification in the pineal region, especially when they extend over a larger area than a normal pineal body should occupy, suggest a pinealoma (Fig. 1*a* and *b*). Plaques of calcification in the tentorium cerebelli, which in the lateral roentgenogram may imitate calcification in a pinealoma, are readily identified in the Towne projection by the arrangement of the plaques in the form of an inverted "V."

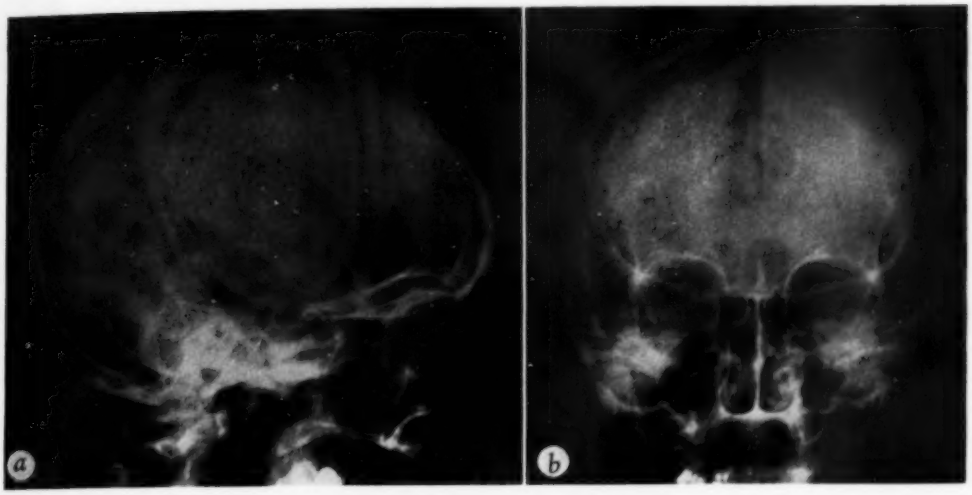


Fig. 3. Intracranial lipoma. *a*. Lateral view of skull revealing curvilinear deposits of calcium in the peripheral portion of the tumor. The central portion is rarefied and less dense than surrounding structures. *b*. Postero-anterior roentgenogram revealing parasagittal situation of intracranial lipoma. The calcification in the periphery of the tumor and the central rarefaction due to the fat are well shown.

Teratomas of the pineal body may exhibit combinations of calcium, bone, and fat, producing roentgenographic shadows of varying density. The fatty portion generally appears to surround the calcium and bone, so that a peripheral shadow of diminished density results (Fig. 2*a* and *b*). This combination of central calcium and peripheral fat seems to distinguish a pineal teratoma from an intracranial lipoma. The latter tumor is nearly always centrally placed, usually more anteriorly than the pineal tumor, and characteristically is dense at the periphery, due to calcium deposits in the wall or capsule, and rarefied in the central portions, due to the fat (Fig. 3*a* and *b*).

Teratomas arising anteriorly from the floor of the third ventricle may be associated with sexual precocity and thereby simulate a pinealoma clinically. Radiographically, these tumors in my experience have all exhibited the same combination of densities as observed in pineal teratomas, and the radiolucent component of the shadow due to fat should help in making the differentiation from a calcified craniopharyngioma, which may also involve the third ventricle.

DISPLACEMENT OF SHADOW OF THE PINEAL BODY

The pineal body normally is in such constant relation to other structures within the cranium that displacement of a calcified pineal body from its normal position is an important roentgenologic sign of intracranial tumor. According to Vastine and Kinney (1), such displacement occurs in 39 per cent of all cases of tumor of the brain; therefore, even a tumor which does not contain calcium may be located by its effect on the position of a calcified normal pineal body. The displacement may be in any direction, depending on the size and position of the mass. It is purely a mechanical effect, which may be modified by the varying degree of cerebral edema that is present in many cases of tumor. A shift of the pineal body in one plane will indicate a contralateral mass. A shift in two or more directions is of greater importance because it enables a more precise localization of the site of the tumor. It is my belief that the significance of such combinations of shift is frequently underestimated.

Seventy-one per cent of tumors of the frontal lobe produce a posterior displace-

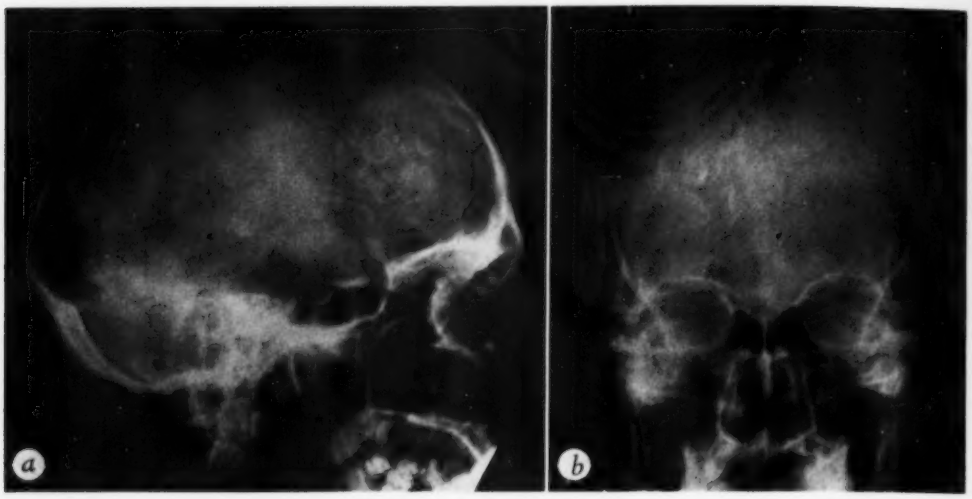


Fig. 4. Calcified oligodendroglioma. *a*. Lateral view of skull revealing characteristic coarse and wavy strands of calcification within the substance of the tumor, which was situated in the left frontal lobe. The shadow of the pineal body is displaced posteriorly. *b*. Calcification within an oligodendroglioma of the left frontal lobe. The shadow of the pineal body is displaced slightly to the opposite side.

ment of the pineal body. If there is no lateral shift, the tumor is in the mid-line or close to it, and usually is basal. Parasagittal frontal tumors of any size may produce a downward displacement of the pineal body as well The degree of posterior shift will diminish as the site of the tumor of the frontal lobe is moved laterally, and a shift from the mid-line may also develop, depending on the size of the tumor.

A lateral shift of the pineal body is a very important sign, as it will lateralize a lesion and not infrequently eliminate the need for pneumographic studies. It occurs most frequently with tumors of the temporal lobe (50 per cent), which may exhibit posterior shifts as well (40 per cent). There may be some difficulty in distinguishing a displacement of the pineal body due to a tumor of the temporal lobe from that caused by a lateral neoplasm of the frontal lobe, but, generally speaking, the degree of lateral shift exceeds the posterior shift in cases of temporal lobe tumor whereas the posterior shift is the greater in most cases of tumor of the frontal lobe.

Vastine and Kinney observed downward displacement of the pineal body in 47 per cent of tumors of the parietal lobe, a forward displacement in 44 per cent of tumors of the occipital lobe, and an upward displacement in 33 per cent of subtentorial tumors.

When evaluating displacements in the anteroposterior or vertical directions, consideration must be given to the configuration of the calvarium, since location curves are based on skulls of average size. It is not unusual for a normal pineal body to be situated posterior to the average position in a scaphocephalic skull, and in a turricephalic head the pineal body may normally lie below the anticipated average site. Such variations should not be interpreted as evidence of disease.

DISPLACEMENT OF THE CHOROID PLEXUS

Varying degrees of calcification occur normally in the choroid plexus of the lateral ventricles. Because the shadows of such calcification are usually symmetrical and equidistant from the median line, variations in their position or asymmetry of the shadow of the choroid plexus formerly was thought to be indicative of a contiguous mass lesion. It has since been shown that the position of the choroid plexus may vary normally, and occasionally with changes in

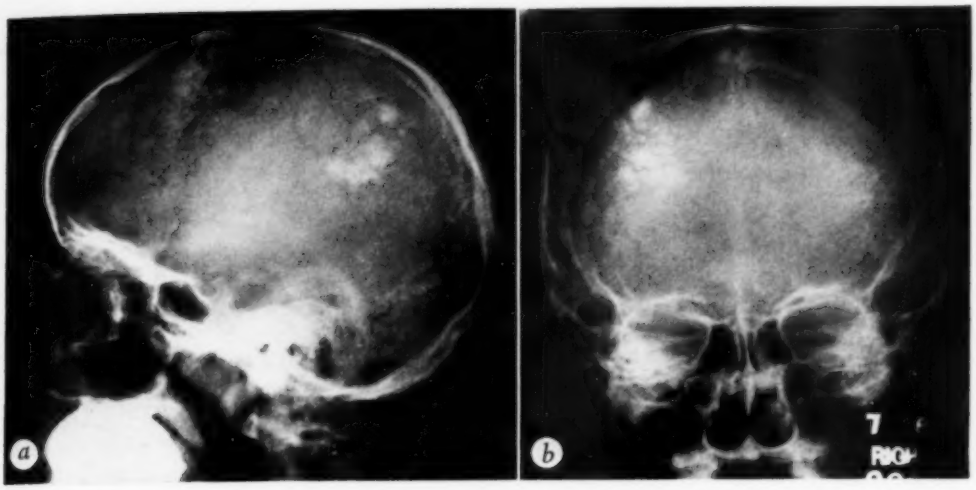


Fig. 5. Ependymoma. *a*. Lateral view of skull revealing conglomerate collection of discrete punctate shadows of calcification within the tumor. *b*. Postero-anterior view revealing subcortical situation of tumor.

posture. Because of this normal variation, asymmetry in the arrangement of shadows of the choroid plexus should not be considered as evidence of a space-occupying intracranial lesion.

NEOPLASTIC CALCIFICATION

Roentgenographic evidence of calcification is found in 15 per cent of all intracranial tumors (3). Considered as a whole, this figure does not seem high or significant, but when the incidence as related to specific tumors and their situation is observed, calcification in the tumor becomes of great importance.

Gliomas

Gliomas make up 49 per cent of all brain tumors, and 15 per cent exhibit calcification in the roentgenogram. The incidence of calcification varies considerably with the type of glioma, being highest in oligodendrogliomas, 39 per cent of which exhibit calcification roentgenographically (3). The calcification occurs predominantly in irregular, subcortical strands, and extends over a relatively large area (Fig. 4*a* and *b*). This configuration is almost typical of this tumor, although it may be imitated by the astrocytoma. The latter is more common, however, in persons under forty years of age and shows calcification in only 13 per cent of cases. In some instances, a glioma may undergo cystic change, and part of the calcification, if present, may exhibit a curvilinear distribution suggesting the presence of a cyst.

Ependymomas, which are seen most commonly between one and twenty years of age, exhibit a type of calcification in the roentgenogram that is grossly identical with that seen in meningiomas. An ependymoma can be distinguished from a meningioma by its subcortical site and by its occurrence in children and adolescents, in whom meningiomas are exceedingly rare. The typical conglomerate collection of discrete punctate shadows of calcification is well shown in Figure 5*a* and *b*. It occurred in 27 per cent of ependymomas studied by Gilbertson (3). If cerebral ependymomas alone are considered, the incidence of calcification increases considerably (40 to 60 per cent). Ependymoma is the only type of glioma which produces punctate calcification in children. The form and distribution of the calcification in roentgenograms are so typical of ependymoma that they merit more serious consideration when the pathologist finds it difficult to decide whether a tissue in

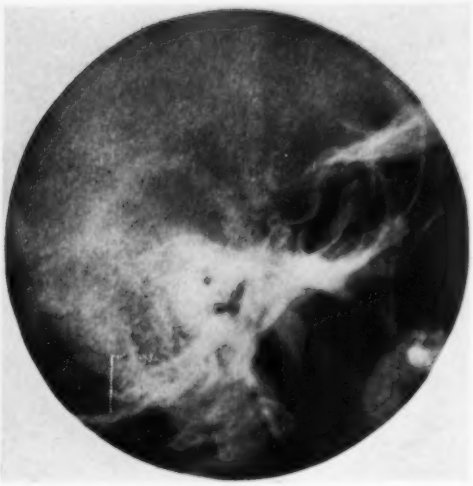


Fig. 6. Craniopharyngioma. Lateral roentgenogram revealing irregular shadows of calcification within the tumor. There is secondary erosion of the posterior clinoid processes, dorsum sellae, and floor of the sella turcica.

question is an ependymoma containing oligodendroglioma cells or *vice versa*.

Calcification sufficient to be discerned roentgenographically occurs in only 4.4 per cent of cases of spongioblastoma and glioblastoma multiforme. When present, it is usually similar to the calcium streaks observed in an oligodendroglioma.

Craniopharyngiomas

Craniopharyngioma produces roentgenologic evidence of calcification more frequently than any other intracranial tumor. McKenzie and Sosman (4), in their original contribution concerning this tumor, reported finding roentgenographic evidence of calcification in 70 per cent of their cases. Love and Marshall (5), in a more recent and larger series of 108 cases, observed roentgenographic evidence of calcification in 56 per cent and microscopic evidence of calcification in 77 per cent. The calcification associated with craniopharyngiomas may be found about the outlet of the sella turcica, above the clinoid processes but especially the posterior ones, posterior to the posterior clinoid processes, and even within the sella turcica itself. The shadows of calcification are usually of a faint, irregular flocculent nature, and may easily be overlooked if the roentgenogram is not of the highest quality and free from evidence of motion. In many instances, there appears to be clumping of the calcium deposits, so that a dense calcified mass with fuzzy indistinct edges may be observed (Fig. 6). The tumor may be large, and in most instances the calcification represents only a part of it. It is not uncommon for

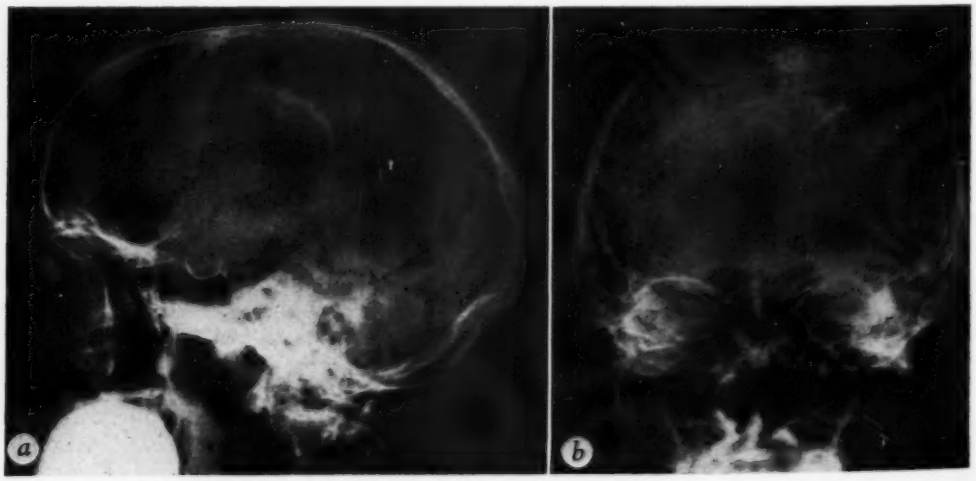


Fig. 7. Cholesteatoma. *a*. Lateral roentgenogram revealing irregular shadows of calcification in the peripheral portion of the tumor. The curvilinear arrangement of the calcium shadows suggests that the tumor is cystic in nature. *b*. Postero-anterior roentgenogram revealing calcification within walls of a cholesteatoma and secondary pressure erosion of the inner table of the overlying calvarium.

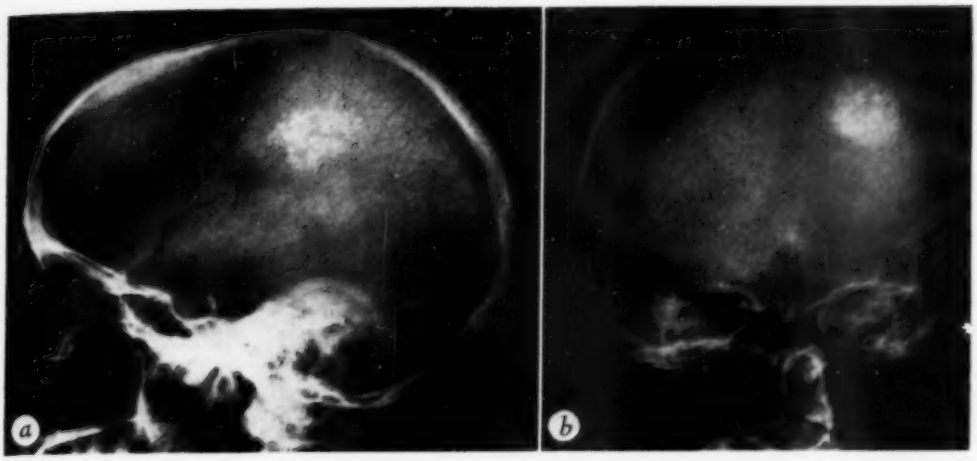


Fig. 8. Meningioma. *a*. Lateral view of skull revealing characteristic punctate type of calcification within a meningioma in the right parietal area. *b*. Postero-anterior view revealing position of calcified meningioma.

the walls of the craniopharyngioma, which is cystic, to be calcified in a plaque-like fashion and thus outline the tumor. Occasionally, such a tumor will originate from that portion of the infundibulum inferior to the diaphragm sellae and thus produce changes in the sella turcica suggesting an intrasellar neoplasm. The presence of intrasellar calcification should facilitate the diagnosis of a craniopharyngioma, since calcification within pituitary adenomas or malignant tumors of the pituitary body itself is exceedingly rare. In cases in which the diagnosis is doubtful, the youth of the patient, the association of Fröhlich's syndrome (70 per cent of cases), or a delay in the appearance of ossification centers will help verify the diagnosis.

Secondary changes in the skull resulting from pressure are frequent accompaniments of craniopharyngiomas. The posterior clinoid processes are usually involved, and these structures, which are commonly eroded from above, may be destroyed altogether. Fragments of the clinoid processes may simulate areas of calcification.

Calcification in dermoids and cholesteatomas may be mistaken for calcification in a craniopharyngioma.

Intracranial cholesteatomas not infrequently exhibit irregular deposits of calcium in the walls of the cystic tumor and even within the contents of the tumor itself. The peripheral distribution of calcium, which suggests a cystic tumor, should lead one to consider a cholesteatoma. These tumors are of slow growth, and secondary thinning of the overlying skull due to pressure is not uncommon (Fig. 7*a* and *b*). When a calcified cholesteatoma occurs in the parasellar region, a distinction from an atypical craniopharyngioma or large aneurysm of the internal carotid artery may not be possible roentgenographically without the aid of cerebral angiography.

Meningiomas

Eighteen per cent of meningiomas produce roentgen evidence of calcification. The calcium deposits have a characteristic roentgenographic appearance which is imitated only by those occurring in the ependymomas. The calcification, which represents calcium deposits in the psammoma bodies of the tumor, has a typical punctate appearance in the roentgenogram (Fig. 8*a* and *b*). In many instances, the small punctate, discrete areas of calcification are so compact that the mass appears to be almost homogeneous and to outline the entire tumor (Fig. 9*a* and *b*). These tumors fundamentally occur on the surfaces of the brain, and especially in the parasagittal

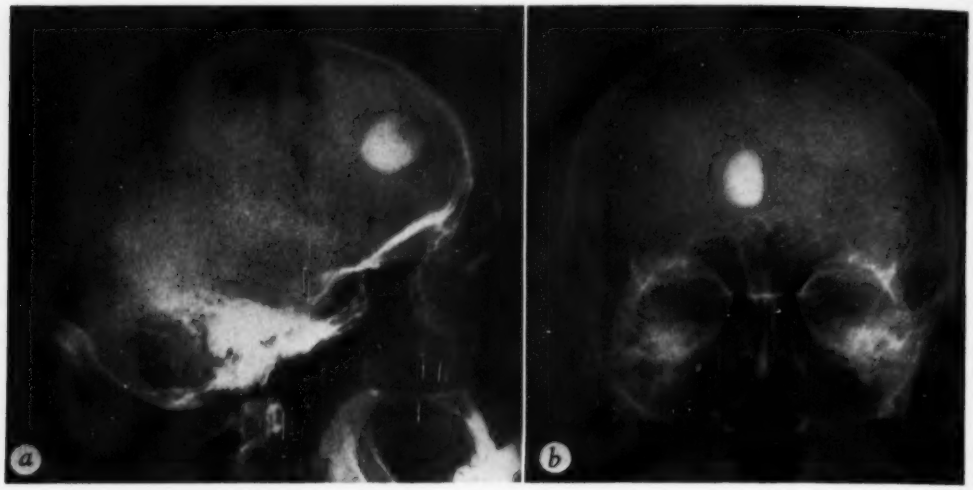


Fig. 9. Left frontal parasagittal meningioma. *a.* Calcification within the tumor is so compact and homogeneous that the entire mass is outlined by the zone of calcification. *b.* Antero-posterior roentgenogram revealing parasagittal situation of calcified left frontal meningioma.

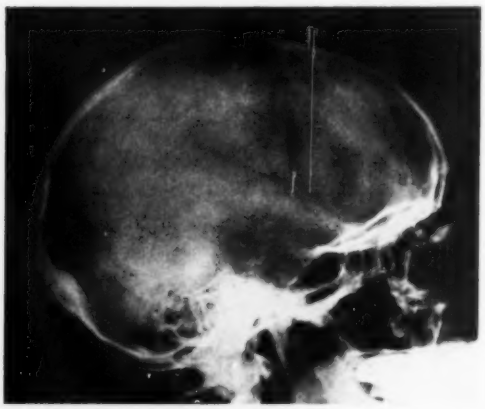


Fig. 10. Chromophobe adenoma of pituitary body. Lateral roentgenogram of skull revealing curvilinear plaque-like shadows of calcification within a portion of the cystic wall of the tumor. There is considerable secondary erosion of the sella turcica.

region. In about 50 per cent of cases there is an associated osteoma in the contiguous bone. Although calcification within a meningioma may simulate the calcification associated with ependymomas, these tumors can be distinguished, first by the fact that meningiomas are surface tumors, and, secondly by the fact that they rarely affect persons less than twenty years of age.

In a small percentage of cases of meningioma, plaque-like calcification may occur in the contiguous meninges, and this calcification may be interpreted as calcification within the walls of the tumor itself. When such plaques of calcification are seen contiguous to a meningioma, they are usually associated with a displacement of the meninges from their usual position, and this point will help to distinguish this form of meningeal calcification from that which frequently occurs normally in the falx or parasagittal meninges.

Pituitary Tumors

Chromophobe adenomas of the pituitary body produce roentgenographic evidence of calcification in 4 per cent of cases. In all cases that I have observed, the calcification has been limited to a small curvilinear plaque-like shadow which outlines part of the wall of the cystic area in the tumor (Fig. 10). In several cases, the curvilinear plaque has closely imitated the appearance of calcium in the wall of the neighboring internal carotid artery and even an aneurysm of that structure. In such cases, if the secondary erosion of the sella turcica lacks uniformity or is greater on one side than the other, cerebral angiography may be necessary to make a differential diag-

nosis of a primary pituitary tumor and aneurysm of the internal carotid artery. Plaque-like calcification may occur in chromophobe adenomas following roentgen therapy, and this change is thought to indicate a favorable response.

I have never observed roentgenologic evidence of calcification in an eosinophilic adenoma or malignant pituitary tumor. I have noted a small nodule of calcification 3 mm. in diameter within the sella turcica in a case of pituitary basophilism.

Vascular Tumors

Primary vascular lesions involving the blood vessels of the brain are receiving increasing consideration today because of greater use of cerebral angiography. These vascular lesions are usually of two types: (1) vascular malformations and (2) a smaller group consisting of true tumors of vascular origin. Because of the vascular component of each group, it may be difficult to distinguish malformation from true tumors in plain roentgenograms alone. According to Schwartz (6) 50 per cent of vascular malformations exhibit calcification in roentgenograms. Calcification in hemangioblastomas involving the posterior fossa in children is rare. Two types of calcification are observed in association with vascular malformations and true vascular tumors: (1) calcification within the walls of dilated vessels or aneurysms, and (2) calcification within contiguous areas of the brain, which is usually atrophic. A detailed consideration of these changes is given elsewhere (7).

CONCLUSIONS

In the roentgenologic consideration of intracranial shadows of calcification, the examiner should bear in mind that there are numerous non-neoplastic lesions which may exhibit roentgenographic evidence of calcification. The roentgenographic characteristics of such lesions are now fairly well established and have been described in a previous article (7). If the examiner will give careful consideration to the character of the intracranial calcification, particularly as to whether it is situated on the surface or within the brain, or whether it is unilateral or bilateral, he should be able to predict the presence of a brain tumor in an increasing percentage of cases. When this information is combined with careful observations concerning the direction of displacement of the shadow of a calcified pineal body, the radiologist can facilitate the accurate localization of intracranial neoplasms without the use of more complicated diagnostic procedures.

Section on Roentgenology
Mayo Clinic
Rochester, Minn.

REFERENCES

1. VASTINE, J. H., AND KINNEY, K. K.: Pineal Shadow as an Aid in the Localization of Brain Tumors. Am. J. Roentgenol. **17:** 320–324, March 1927.
2. BAGGENSTOSS, A. H., AND LOVE, J. G.: Pinealomas. Arch. Neurol. & Psychiat. **41:** 1187–1206, June 1939.
3. GILBERTSON, EVA L.: Roentgenographic Signs of Tumors of the Brain. Thesis, University of Minnesota Graduate School, 1946.
4. MCKENZIE, K. G., AND SOSMAN, M C.: Roentgenological Diagnosis of Cranio-pharyngeal Pouch Tumors. Am. J. Roentgenol. **11:** 171–176, 1924.
5. LOVE, J. G., AND MARSHALL, T. N.: Craniopharyngiomas (Pituitary Adamantinomas). Read at the 4th International Neurological Congress, Paris, France, Sept. 5 to 10, 1949.
6. SCHWARTZ, C. W.: Recognition of Some Forms of Intracranial Lesions. Am. J. M. Sc. **190:** 220–225, August 1935.
7. CAMP, J. D.: Pathologic Non-neoplastic Intracranial Calcification. J. A. M. A. **137:** 1023–1031, July 17, 1948.

(*Para el sumario en español, véase la página siguiente.*)

SUMARIO

Importancia de la Calcificación Intracraneal en el Diagnóstico Roentgenológico de las Neoplasias Intracraneales

En el estudio roentgenológico de las imágenes intracraneales de calcificación, el examinador debe tener presente que existen numerosas lesiones no neoplásicas que pueden acusar signos roentgenográficos de calcificación. Las características roentgenográficas de dichas lesiones ya están bastante bien establecidas. Si el examinador presta cuidadosa atención a la naturaleza de la calcificación intracraneal, y en particular a si se halla situada en la superficie o en la sustancia cerebral, y a si es unilateral o bilateral, debe poder predecir la presencia de un tumor cerebral en un porcentaje cada vez mayor de casos. Si combina esa información con esmeradas observaciones de la dirección que toma el desplazamiento de la imagen de un cuerpo pineal calcificado, le resultará más fácil al radiólogo localizar con exactitud los neoplasmas intracraneales sin tener que emplear procedimientos más complicados.

Pulmonary Adenomatosis

A Report of Four Cases[1]

J. CASH KING, M.D., and DAVID S. CARROLL, M.D.
Memphis, Tenn.

IN 1939 BONNE reported a peculiar disease of the lungs in a 39-year-old Chinese, in which there existed a diffuse process of epithelial proliferation throughout the pulmonary alveoli. The symptoms were dyspnea, productive cough, and weight loss; and the disease killed the patient, although invasive and destructive growth was not present. Bonne stressed the resemblance to jaagsiekte in sheep and called the disease carcinosis. Since that report, cases have been found and diagnosed more and more frequently, and because the roentgenologist is often the first to see the changes in the lung, it is appropriate that we devote more time to the study and consideration of this condition. In this report we shall discuss the present status of the disease and add 4 cases, 3 of which have microscopic confirmation.

PATHOLOGY

In benign pulmonary adenomatosis firm nodules, varying in size, are scattered throughout both lungs. Grossly, these nodules resemble areas of pneumonic consolidation. On cut section, they have the appearance of the gray hepatization stage of pneumonia, and a mucoid material can be expressed from the areas of involvement. The bronchi are filled with frothy, thin mucoid material, and areas of congestion and edema are present throughout the lungs. Terminally there is usually a considerable degree of pneumonic consolidation superimposed upon the adenomatosis. The pleura is usually not involved but may show areas of fibrinous or fibrous adhesions. In the typical case there are no metastases either in the regional lymph nodes or in distant organs.

Microscopically, the process is much more extensive than one would suspect from the gross examination. The alveoli are lined by cuboidal and columnar epithelium, and in many areas there is overgrowth of the epithelium to form papillary extensions into the alveolar spaces. The alveolar lining cells are usually quite uniform in appearance and are non-ciliated. There are few or no mitotic figures. The alveolar septa are not invaded, and there is no extension into the interalveolar tissues. The walls of the alveoli are edematous, and there is a varying degree of fibrosis of the interstitial supportive tissues.

CLINICAL FEATURES

Dyspnea is the most constant feature of pulmonary adenomatosis, increasing in severity throughout the course of the disease. This can readily be explained by the microscopic findings. The remarkable hyperplasia of the epithelium in the alveoli interferes to a great extent with the gaseous exchange between the alveoli and pulmonary capillaries. Furthermore, the accumulation of mucoid material in the bronchi interferes with the passage of air to the alveoli. Cough is also a constant and striking feature. In the early stages the cough is productive of very small quantities of thin, watery mucoid sputum, but as the disease progresses the cough increases in severity and production of 40 to 50 ounces of sputum in a twenty-four-hour period is common. Hemoptysis does not usually occur except in the terminal stages, when pneumonia complicates the condition. Loss of weight is another rather constant symptom and during the course of the disease may amount to as much as 35

[1] From the Department of Radiology, University of Tennessee College of Medicine, Memphis, Tenn. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

to 50 pounds. As the cough becomes increasingly severe, the patient usually has anorexia, and loss of weight and weakness become a more prominent part of the clinical picture.

The physical findings are of little help in the diagnosis of benign pulmonary adenomatosis. Dullness to percussion is elicited over the involved areas and medium moist râles are heard usually throughout both lung fields. The temperature is normal unless complications such as pneumonia are present.

The laboratory studies, with the exception of the microscopic study of the lung tissue, are also all within normal limits. The blood count is normal, blood chemistry has been within normal limits, and sputum studies have consistently been negative for acid-fast bacilli and fungi.

The disease runs an afebrile, gradually downhill course. The duration of symptoms is from a few months to two or three years, the average being about one year. The patient dies as the result of asphyxia and terminal pneumonia.

ROENTGENOGRAPHIC FEATURES

Roentgenographic studies of the chest are of utmost importance in the diagnosis of pulmonary adenomatosis. As a rule, the disease is extensive and involves a considerable part of both lungs when the patient is first examined. The distribution of the lesions varies in different cases, but in general the areas of greatest involvement are in the central lung zones and in the bases. There may be much more extensive involvement of one lung than the other. Occasional cases are encountered in which the disease apparently remains localized to one lobe for a period of months, or even years. Such cases have been infrequent thus far, but with increasing knowledge of the disease, the localized form may make up a higher percentage of the cases in the future.

The roentgen pattern is of two types. In the first type, the areas involved show innumerable nodular densities. These nodules cast a relatively soft shadow and are rather poorly delineated, fading somewhat indistinctly into the normal lung tissue. They vary in size from about 2 mm. to about 1 cm. in diameter. In areas of greater involvement, the nodules become confluent. The other type of pattern is a homogeneous density resembling areas of pneumonic consolidation.

The lesions progress relatively slowly, and serial films over a period of several weeks show very little change. A negative finding of considerable importance is the absence of hilar or mediastinal adenopathy. The absence of pleural effusion is also worthy of note.

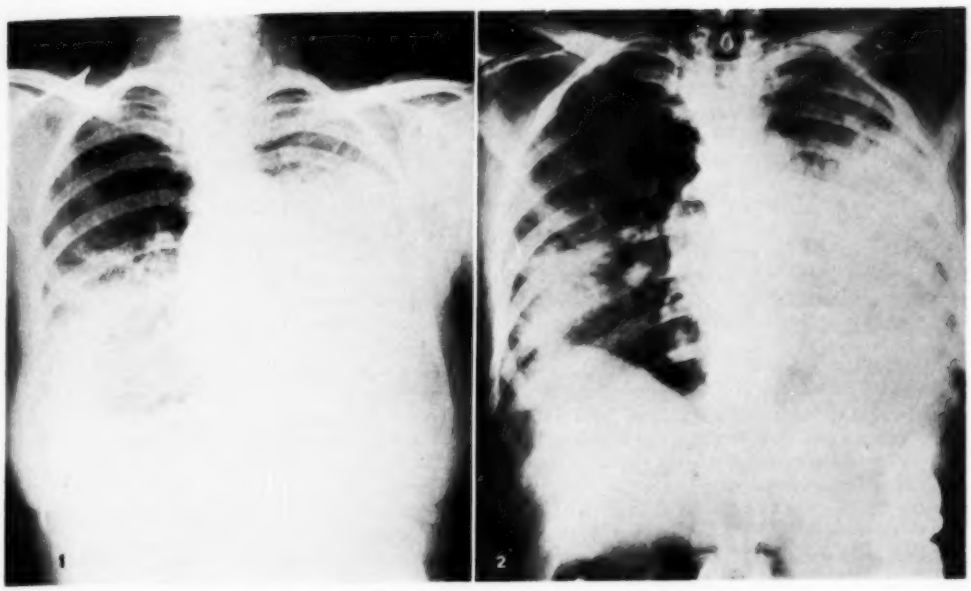
Although a single roentgenogram of the chest is not characteristic of pulmonary adenomatosis, and is therefore not diagnostic, a correlation of the clinical features with the roentgenographic findings, particularly on serial examinations, should lead to the diagnosis in a fairly high percentage of cases.

CASE REPORTS

CASE I: E. F., a 63-year old colored female, was admitted to the Medical Section of the John Gaston Hospital on July 22, 1948, complaining chiefly of cough and expectoration. Her present illness had begun one year previously, when she "caught cold." The cough, associated with the other respiratory symptoms, persisted, and a slight amount of expectoration developed. The cough had continued since the onset of the disease and had been productive of copious clear, watery, frothy sputum. Only rarely were small streaks of red blood observed in the sputum. There had been no chest pain and no fever or chills, but there were frequent night sweats. Dyspnea had appeared during the year and increased progressively, so that on admission the patient was mildly dyspneic on bed rest and markedly so on walking. There was no anorexia and no other gastro-intestinal symptoms were present. The patient stated that she had lost 50 to 60 pounds during the year's illness.

The past history was negative, and there had been no known contact with tuberculosis. The only contact with animals was that the patient frequently cleaned and ate rabbits.

Physical examination on admission showed a temperature of 99.2 degrees, pulse 90, respirations 24, and blood pressure 130/80. The patient appeared chronically ill and was coughing and expectorating large quantities of clear, foamy, thin sputum. She appeared in no acute discomfort, although she was slightly dyspneic. There was sym-



Figs. 1 and 2. Case I. Pulmonary adenomatosis. Figure 2 was made with grid technic.

metrically poor expansion of the thorax. Percussion yielded a dull note over the lower two-thirds of the left and lower one-half of the right lung field. Tactile fremitus seemed normal. Breath sounds were symmetrical in intensity, were bronchovesicular over the above-mentioned areas, and medium moist inspiratory râles were heard throughout each lung field. Examination of the heart, abdomen, extremities, pelvic organs, rectum, skin, lymphatic and neuromuscular systems were considered to show no abnormal physical signs.

The white blood count was 8,500, with a normal differential count. The red blood count was 5,500,000; hemoglobin was 15 gm. per cent and the hematocrit reading 45 per cent. Non-protein nitrogen was 39 mg. per cent. Total serum protein was 7.6 gm. per cent: albumin 4.3 gm. per cent; and globulin 3.3 gm. per cent. Six sputum studies for acid-fast bacilli and three for fungi were negative. Two gastric washings were negative. The Kahn test was negative, as were the agglutination series. First strength Mantoux reaction was negative; second strength was 1 to 2 plus. The arm to tongue circulation time was 18 seconds.

On Aug. 2, 1948, serum albumin was 4.9 gm. per cent, globulin 4.5 gm. per cent. A repeat urinalysis on the tenth day of hospitalization showed specific gravity 1.020, *p*H of 5, negative glucose and acetone, 1 plus albumin, 10 to 20 white blood cells per high-power field, 5 to 10 red blood cells, a few granular and a few hyaline casts. The twenty-four-hour sputum volume varied from 600 to 1,000 c.c. and the sputum was always of the same gross character as previously described.

A roentgenogram of the chest (Fig. 1) revealed a rather homogeneous increased density involving almost all of the left lung, only the apex being clear. The lower half of the right lung field was involved in a similar process. A recheck examination was immediately made, using Bucky technic (Fig. 2), and the areas of pulmonary involvement were shown to consist of innumerable confluent areas of nodular increased density. The pleural spaces showed no evidence of fluid. The heart size could not be evaluated, since the pulmonary involvement on the left side obscured the left border of the heart. The hilar lymph nodes were apparently not enlarged. Although the changes as seen on the roentgenograms were not considered characteristic, evaluation of the clinical symptoms together with the roentgen findings led to a provisional diagnosis of pulmonary adenomatosis by the Department of Radiology. Repeat roentgen studies on the tenth and twelfth days after admission showed no change.

Bronchoscopy was done but there was no evidence of tumor. The mucous membranes were pale greenish-white in color and there was a copious amount of thick, grayish-white frothy material in the lumina of the larger bronchi. The aspirated material from the bronchi was examined by the Department of Pathology and microscopic examination revealed many long and short strips of columnar epithelium supported by a fibrous base. The nuclei were hyperchromatic. Some goblet mucous cells were seen. On the tenth day an aspiration biopsy was performed over the area of maximum dullness in the left lung field posteriorly. Microscopic examination showed lung tissue which was quite abnormal.

The alveoli were lined by tall columnar epithelium, which was pseudo-stratified in places. No mitotic figures were seen. This type of epithelium was seen generally throughout the specimen, although in individual alveoli the lining would approach the cuboidal. Diagnosis by the Department of Pathology was pulmonary adenomatosis.

During the course in the hospital the patient showed no fever. Oxygen by nasal catheter was the only therapy. The dyspnea and cough became progressively worse. On the sixteenth day there was a slight temperature elevation, reaching 101.2 degrees on the seventeenth day. At this time the patient was stuporous, extremely dyspneic, and showed cyanotic nail beds and mucous membranes. She died on the eighteenth hospital day.

Autopsy: The only findings of significance were in the chest. There was no pleural fluid and the pleural surfaces of the lungs appeared normal. The greater portion of both lungs showed innumerable nodular areas resembling consolidation. The sections of the lungs presented the most striking feature of the case. In the sections taken from grossly consolidated areas, the alveoli were lined by tall columnar epithelium with basilar nuclei. Large clumps of these columnar cells were found in the alveolar spaces. The tall columnar cells formed a single lining layer in the alveoli and did not invade the interstitial tissue. In a few of the sections the interstitial tissues were infiltrated by inflammatory cells and the alveoli filled with inflammatory exudate containing large numbers of polymorphonuclear leukocytes, lymphocytes, and plasma cells. The columnar cells lining the alveoli were remarkably uniform. Their nuclei for the most part were situated basally and showed little variation in size, shape, or staining characteristics. No mitotic figures were observed. No vacuoles were noted in the cytoplasm and carmine stains failed to reveal the presence of mucus. There was no evidence of invasion of the interstitial tissue of the alveoli and there was no metastasis either to the regional lymph nodes or to distant organs. The heart showed moderate dilatation of the right ventricle.

Comment: **This case is particularly interesting because it is one of the few cases in which the correct diagnosis was made antemortem from evaluation of the clinical and radiographic features. Furthermore, as far as we can determine, it is the first case reported in which the diagnosis was confirmed before death by aspiration biopsy.**

CASE II: Mrs. D. G., a 58-year old white female, was first admitted to the John Gaston Hospital on March 12, 1945. She had had an acute onset of fever three days earlier, with temperature as high as 104 degrees. She complained of pain on respiration beneath the anterior left rib margin and had had intermittent nausea and vomiting for the past three days.

The past history indicated that the patient had had chronic gallbladder disease for twenty years, but had had no operations or accidents. She had influenza in 1918 and again in 1944. She stated that she was subject to rather frequent respiratory infections.

The temperature was 101 degrees, pulse 96, respirations 20, and blood pressure 130/65. There was bronchovesicular breathing over the left lung base, although no dullness was found on percussion. Coarse râles were heard on deep inspiration over the left base. Physical examination was otherwise normal.

X-ray examination of the chest revealed a patchy increased density in the base of the left upper lobe. The heart size was within normal limits.

The red blood count was 4,160,000, hemoglobin 12.8 gm., white blood count 6,950, with a normal differential count. Urinalysis was negative. Blood culture and agglutination studies were negative, and the Kahn test was negative.

The patient was treated with sulfadiazine and ran a mild febrile course for five days, after which the temperature was normal and she became asymptomatic. However, recheck examinations of the chest on March 22, April 2, and April 15, 1945, still revealed the streaking of increased density in the left lower lobe, which was interpreted as chronic pneumonitis. The patient was discharged on April 5, with a diagnosis of acute interstitial pneumonia due to a virus.

The next admission to the hospital was on Feb. 4, 1947, when the patient complained of fatigue, lassitude, and some shortness of breath for the past six days, and chills and fever for the past two days. There was no cough and no chest pain. The patient stated that she had been well since the previous admission.

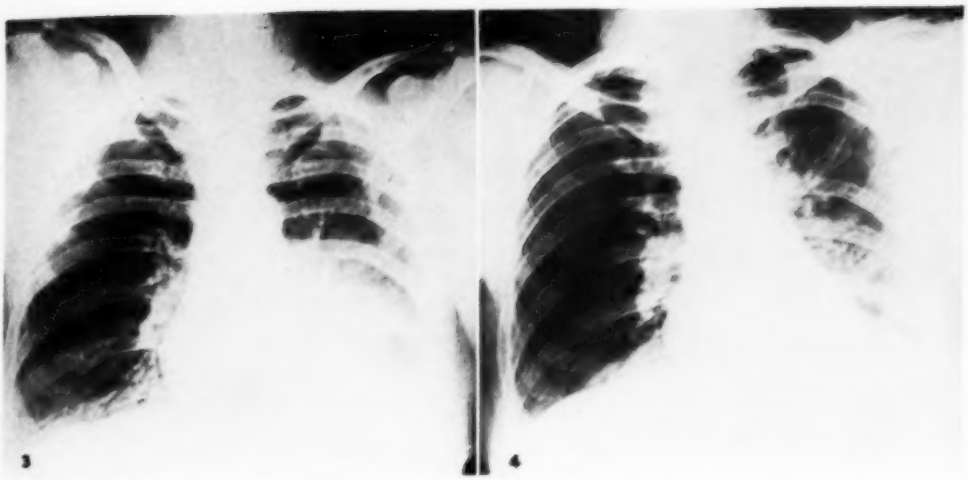
Physical examination revealed a temperature of 102 degrees. There was dullness over the lower left chest posteriorly and a few crepitant inspiratory râles were heard over this area.

Laboratory examination showed the white blood count to be 10,850, with 79 per cent granulocytes and a slight shift to the left. Urinalysis and blood culture were negative. Heterophile antibody agglutination was negative.

A roentgenogram of the chest again revealed patchy pneumonia in the left lower lobe, but the lung fields were otherwise clear.

The patient was again treated with sulfadiazine, ran a mild febrile course with no cough or chest pain, and was discharged on Feb. 24, 1947, with a final diagnosis of virus pneumonia. However, a roentgenogram of the chest on Feb. 21 still revealed patchy areas of increased density in the left base, which had shown little or no clearing since the original examination.

The patient was next readmitted to the hospital



Figs. 3 and 4. Case II. Fig. 3. Preoperative film, showing pulmonary adenomatosis apparently localized to left lower lobe. Fig. 4. Film made about one month after lobectomy, showing evidence of disease in the remaining left upper lobe.

on June 7, 1947. At that time she complained of nasal stuffiness of three days duration and pain in the lower left chest for two days. She stated that she had been well since the last hospitalization.

The temperature was now 99.5 degrees, pulse 84, respirations 24, and blood pressure 150/80. There were depressed breath sounds over the posterior and lateral lower thirds of the left lung, and inspiratory râles were heard over the same areas. The white blood count was 8,250.

X-ray examination of the chest again revealed patchy infiltrations in the left base.

Because of the recurrent attacks of pneumonia in the left lower lobe, bronchoscopy was done. The findings were entirely negative except for an increase in the amount of mucus encountered in the left lower lobe bronchus. Bronchography was also done and showed no evidence of filling defect or dilatation in the left lower lobe bronchi.

The patient was discharged on June 21, with the diagnosis of primary atypical pneumonia.

On Feb. 8, 1948, the patient was again admitted to the hospital. Since the last hospitalization she had been following a regime of postural drainage, ammonium chloride, and general protection against exposure to cold, avoiding undue fatigue. Two days prior to this admission a cough developed, which was productive of a moderate amount of purulent sputum. There had been a fever of 100 to 102 degrees and generalized aching.

On admission the temperature was 100.2 degrees, pulse 88, respirations 24, blood pressure 120/64. Physical findings previously encountered were again noted on this examination.

The white blood count was 20,700, with 88 per cent granulocytes and a slight shift to the left.

The patient ran a febrile course for only two days, being treated by sulfadiazine, and was afebrile from the third day on.

X-ray examination of the chest at this time revealed a moderately extensive consolidation in the left base, and examination in the anteroposterior and lateral positions by Bucky technic offered no evidence of abscess. Bronchoscopy was again done, because of the repeated attacks of pneumonia in the left lower lobe, and was again negative, except for showing purulent sputum coming from both lower lobe bronchi. Microscopically the bronchoscopic washings showed cells surrounded by albuminous matter, fibrin, and hyaline amorphous material. Groups of these cells superficially appeared to be giant cells, but careful examination showed that they were apparently epithelial cells which had sloughed off. No malignant or tumor cells were noted. A bronchogram was again obtained and was interpreted as showing minimal cylindrical bronchiectasis in the left lower lobe. The diagnosis on discharge, May 27, 1948, was chronic interstitial pneumonia with acute exacerbation and bronchiectasis due to chronic infection.

The patient was again admitted on Oct. 10, 1948, because of an acute exacerbation of chronic interstitial pneumonia in the left base. Since the previous examination, she had had a cough productive of small amounts of mucoid sputum.

In view of the persistent pathological process in the left lower lobe, the patient was advised to have a lobectomy, and she re-entered the hospital on Oct. 24, 1948, for this procedure. A recheck examination of the chest (Fig. 3) again revealed the patchy consolidation in the left lower lobe, the remaining parts of the lungs being normal. Cholecystography and

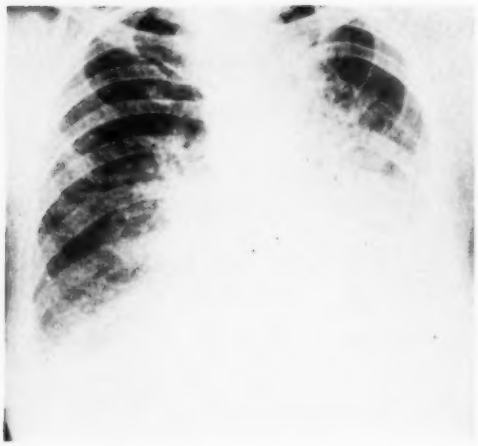


Fig. 5. Case II. Roentgenogram made about three months after surgery, showing gradual progression of disease throughout both lungs.

an upper gastro-intestinal series were done. The gastro-intestinal series was negative, and the cholecystogram revealed cholelithiasis.

On Nov. 29, 1948, thoracotomy was done and the left lower lobe was surgically removed. Examination of the specimen showed the pleura covered by many adhesions. The lung tissue was firm and cut with the consistency of spleen. On microscopic examination, almost all of the alveoli were seen to be lined with columnar epithelium which resembled bronchial mucosa cells though without cilia. Cells were columnar with a uniform appearance and basal nuclei. Alveolar walls were thickened, and the alveolar spaces were filled with hemorrhage and acute inflammatory cells. A few large round cells with a moderately small and eccentrically placed nucleus and granular foamy cytoplasm were noted. There were no mitotic figures in the alveolar lining cells. The lymph nodes removed showed no evidence of metastatic tissue. Diagnosis by the Department of Pathology was pulmonary adenomatosis.

After the patient recovered from the operation she was still coughing, the cough being productive of small amounts of mucoid sputum. Examination of the chest (Fig. 4) on Dec. 21, 1948, revealed thickening of the pleura at the left base and scattering of nodular infiltrations in the left upper lobe and right base. This was interpreted as a spread of pulmonary adenomatosis. After that time the patient had a progressively severe cough, productive of larger amounts of mucoid sputum, and increasing dyspnea on slight exertion. Further roentgenograms (Fig. 5) showed slow but progressive involvement of both lung fields by the confluent nodular densities.

On April 5, 1949, x-ray therapy was begun over the left lung in an effort at least to reduce the copious mucoid sputum, which by that time was about 42 ounces per day; 1000 r in air was given to each of two 15 x 15-cm. ports, one anteriorly and one posteriorly, over a period of ten days. There was no improvement following x-ray therapy.

The patient was again admitted to the hospital on April 25, 1949, because of very severe dyspnea. On this admission, she was dyspneic even at bed rest and ran a febrile course, the temperature being as high as 102.6 degrees. The course was rapidly downhill and dyspnea became extreme in spite of oxygen administration. Death ensued on May 19, 1949, and no autopsy was performed.

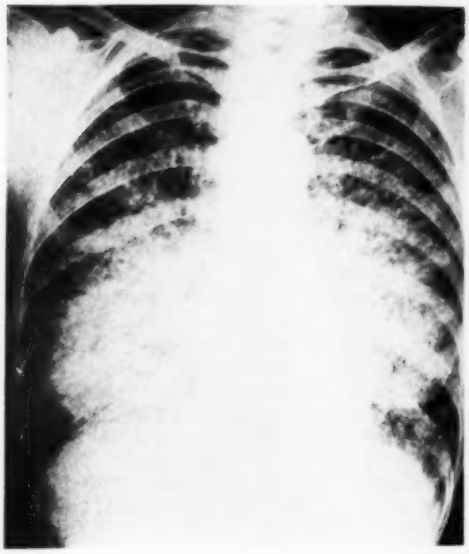


Fig. 6. Case III. Innumerable poorly defined nodular areas throughout both lung fields.

Comment: This case is interesting because the disease was clinically localized to the left lower lobe for almost four years; the diagnosis was established antemortem by lobectomy, and following lobectomy the patient ran a rather rapid downhill course with the usual symptoms of severe productive cough and dyspnea. Of further interest is the complete lack of response to radiation therapy.

CASE III: Mrs. F. S., a 53-year old white female, was admitted to Oakville Memorial Sanatorium on Feb. 26, 1947. She dated the onset of her illness to about six weeks prior to admission, at which time she was seized with generalized aching pains, shortness of breath, and pains in the chest. Initially her appetite was good and she had had no fever. Early in the illness a cough developed, which had

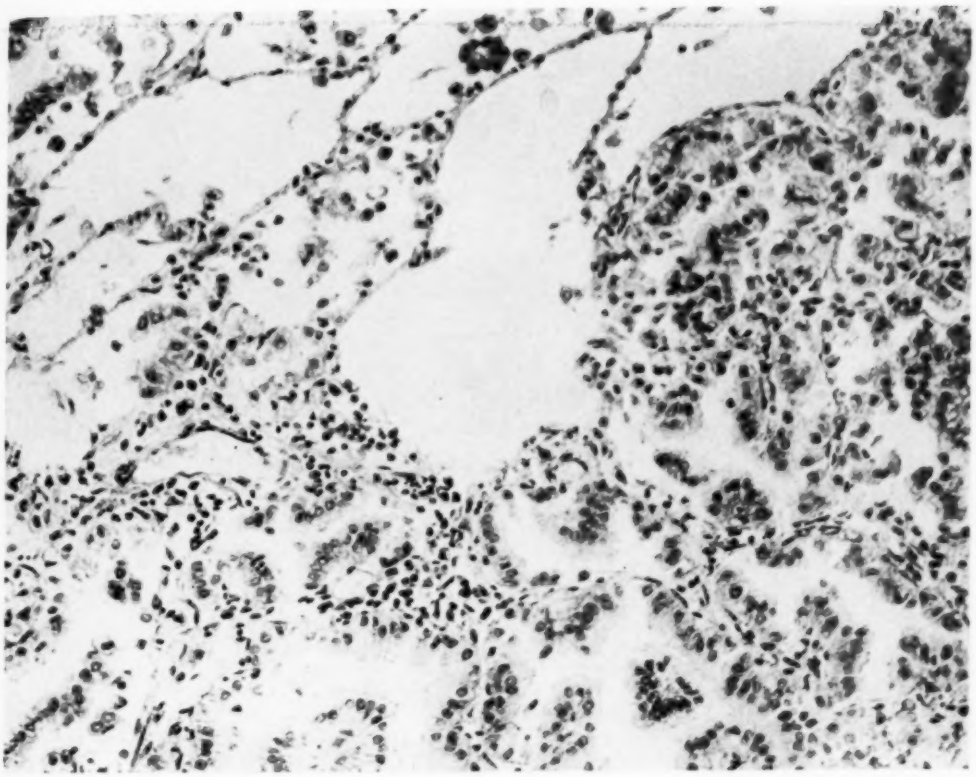


Fig. 7. Case III. Photomicrograph of lung showing transition between normal pulmonary alveoli and alveoli lined by columnar epithelium.

been productive of increasingly large amounts of thin, watery, frothy sputum, as much as a quart in a twenty-four-hour period. For the past few weeks there had been anorexia, nausea, and vomiting and the patient had become increasingly weak and had lost a great deal of weight. There had been no hemoptysis, no night sweats, and no swelling of the feet or ankles.

The past history indicated that the patient's general health had been good. She had had a left-sided pleurisy two years before. There was no family history of tuberculosis, cancer, diabetes, kidney or heart disease.

Physical examination revealed a thin, slender, acutely ill, dyspneic patient who had to sit up in bed and was panting desperately for breath. The lips and fingernails were cyanotic. The temperature was 98.6 degrees, pulse 130, respirations 40. The examination was otherwise completely negative except for the lungs. Chest expansion was full and symmetrical, and tactile fremitus was normal. The percussion note was said to be unimpaired. Numerous fine crepitant râles were heard over the bases of both lung fields.

A roentgenogram of the chest (Fig. 6) revealed no abnormality of the thoracic cage. The diaphragm was normal. The mediastinum showed no abnormality, and the heart was not enlarged. Innumerable soft nodular densities were present throughout both lung fields. The lesions were rather poorly outlined and most numerous in the middle and lower lung fields bilaterally, where the nodular densities were so confluent as almost to obscure the heart shadow. Costophrenic angles were clear on both sides.

The patient ran a rapidly downhill course, during which time she was extremely dyspneic and cyanotic. The cough was quite severe and productive of huge amounts of thin, mucoid sputum. She died on March 3, 1947, and an autopsy was performed four hours after death.

Autopsy: Findings of significance were confined to the lungs. The right lung weighed 1,360 gm., the left 1,250 gm., and a few fine adhesions were noted between the base of the right lung and the diaphragm. The bronchi were filled with sputum, the mucosa being rather pale. On cut section the lung surfaces were mucoid, smooth and shining.

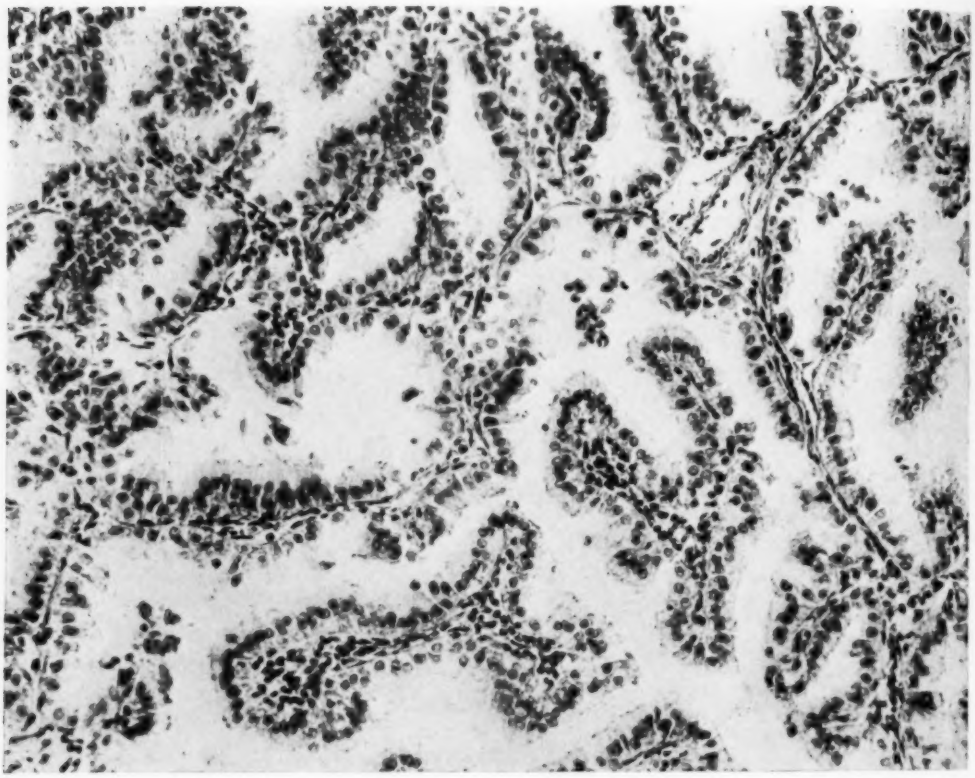


Fig. 8. Case III. Photomicrograph of lung demonstrating the remarkably uniform columnar epithelium lining all of the pulmonary alveoli.

Cultures for acid-fast organisms and Gram stains were negative, and no growth was reported on fungi cultures. Multiple pinkish-white nodules were present throughout all of the lobes of the lungs. These nodules varied from small, discrete foci to large coalescent areas, as much as 3 cm. in diameter. Microscopic section through the nodules showed marked proliferation of atypical cells lining all of the alveoli (Figs. 7 and 8). These cells were monotonous in regularity, were medium tall, columnar, and contained occasional secretory vacuoles in a slight granular cytoplasm. The nuclei were basal with finely distributed chromatin and inconspicuous nucleoli. There was no evidence of mitoses. These atypical cells had invested the walls of the alveoli, using the wall as the tumor stroma on which they grew. In some areas, papillomatous projections into the alveolar space were noted. There was no evidence of metastasis either to the regional lymph nodes or to the distant organs. The final diagnosis was benign pulmonary adenomatosis.

Comment: The course of the disease was much more rapid than in the usual case, the entire symptomatology lasting less than two months. The roentgenograms in this case show the nodular type of density pattern.

CASE IV: M. L. T., a 50-year old white female, was admitted to Oakville Memorial Sanatorium on Nov. 22, 1943. She claimed that she had been perfectly well until the past year. During that year, however, she had lost considerable weight, the exact amount not being known, had had indefinite pains in the chest, and a slight cough with expectoration of a small amount of mucoid sputum. She had been moderately dyspneic on exertion and became more easily fatigued than previously. Past history and family history were not contributory.

The patient was mentally alert and co-operative; she was fairly well nourished and did not appear ill. The physical examination was normal except for the chest. There was increased tactile fremitus over the entire right chest and definite dullness to percussion over its upper two-thirds. The re-

mainder of the chest was clear. On auscultation, moist bubbling râles were heard from the apex to the diaphragm on the right side, with medium râles over the lower fourth of the left chest.

A roentgenogram (Fig. 9) showed the heart size to be within normal limits. The mediastinum was normal and there was no hilar adenopathy. The diaphragm leaves were normal and the costophrenic angles were clear. There was increased density overcasting the greater portion of the right lung field, apparently due to innumerable confluent nodular densities. The lower half of the left lung field also showed innumerable poorly defined confluent nodular shadows.

The patient ran an afebrile course; cough productive of increasing amounts of thin, mucoid, watery sputum and dyspnea on exertion were the only symptoms. Sputum studies were negative on repeated occasions for tubercle bacilli. The blood count was normal on two occasions.

Bronchoscopy was done on three different occasions, and at each time a tremendous amount of thin, watery secretion was aspirated. About one pint of sputum was removed on each occasion. It was not purulent, and the secretions contained no blood. Because of the large amount of secretion present, which required constant aspiration, examination was rather difficult, but no tumor masses or other lesion could be found.

The patient was hospitalized for ninety-one days and was discharged on Feb. 20, 1944. She died at home on July 14, 1944. No autopsy was obtained.

Comment: This patient had the usual symptoms and the usual radiologic and bronchoscopic findings of pulmonary adenomatosis, and ran the usual progressive downhill course to death. Although there is no microscopic confirmation in this case, it is felt that the diagnosis of benign pulmonary adenomatosis is probably correct.

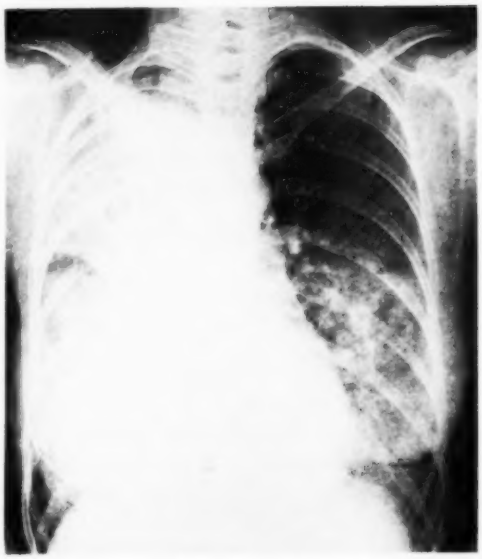


Fig. 9. Case IV. Pulmonary adenomatosis with dense "consolidation" of almost the entire right lung.

DISCUSSION

Speculation as to the origin of the alveolar lining cells is of considerable interest in the study of pulmonary adenomatosis, and there is considerable disagreement among pathologists as to whether these cells represent a proliferation of scattered alveolar epithelial cells or a proliferation of bronchiolar epithelial cells with downgrowth into the alveoli. Geever, Neubuerger, and Davis have made an extensive study of the alveolar lining under various pathologic conditions, in man and animals. They conclude that normally there is no true continuous alveolar epithelial lining in adult life, but that the capillaries are contained in a ground substance in which there are occasional septal cells, these being very likely of mesenchymal origin. There are many conditions under which these septal cells proliferate: bacterial pneumonias, viral pneumonias, lipoid pneumonia, pneumonitis due to x-rays and radium, infectious granuloma, tuberculosis, syphilis, alveolar-cell tumors, silicosis, chronic passive congestion, chronic atelectasis, fibrosis, pleurisy, and empyema. All stages from simple swelling of the septal cells to the formation of a continuous epithelioid lining and to actual neoplastic growth have been observed by Geever and his associates.

Herbut, on the other hand, states that "the focal proliferations of the basal cells of the bronchi and bronchioles, with their extension into the surrounding tissue; their direct linear continuations with the regenerated alveolar cells; the identical morphologic appearance of the two cells; the failure to demonstrate satisfactory transitions between the regenerated cells and the alveolar phagocytes, on the one hand, and the normal inner surface of the septa, on the other; and finally, the absence of pha-

gocytosis by the regenerated epithelium, all point to an origin from the basal cell of the bronchiolar mucosa." However, regardless of the origin of the cell, regenerated alveolar epithelium which is found in such a variety of pathologic conditions and the alveolar-cell tumor must have a common origin.

Geever and Neubuerger have preferred to include pulmonary adenomatosis with alveolar-cell carcinoma as an aiveolar-cell tumor. The metastases found in alveolar-cell carcinoma add to the clinical symptomatology, and the resultant clinical picture is somewhat different. Also, the copious production of mucoid sputum is a more striking finding in the benign alveolar-cell tumor. However, borderline cases have been described, such as the one reported by Sweany, in which a metastatic nodule was found in one bronchial lymph node. Also, two of Paul and Ritchie's cases showed areas of malignant change in an otherwise benign lesion. One must conclude that pulmonary adenomatosis, although usually a benign alveolar-cell tumor, is at least precancerous.

There is disagreement as to whether pulmonary adenomatosis has one focus of origin or multiple foci. Herbut believes that in alveolar-cell tumors there is a primary focus which spreads by bronchioles and lymphatics to the remainder of the lungs. Most authors, however, consider that there are multiple foci of origin throughout the lungs. The benign character of the lesion, with no invasion into interalveolar tissue, lack of regional lymphatic or distant metastases, and the extensive involvement throughout so much of the lung tissue, are in favor of multiple foci of origin.

The etiology of pulmonary adenomatosis, as in the case of most neoplasms, is not known. Grady and Stewart have experimentally induced alveolar-cell tumors in mice by subcutaneous injections of 1,2,5,6-dibenzanthracene or methylcholanthrene. Ernest Wood has reported a case of pulmonary alveolar-cell tumor associated with lipoid pneumonia. The marked similarity of human pulmonary adenomatosis and jaagsiekte in sheep has led to a great deal of speculation on this subject. The disease in sheep, known as progressive pneumonia of sheep in Montana, verminous pneumonia of sheep in Iceland, and as jaagsiekte in South Africa, is epidemic in many parts of the world. The symptoms are dyspnea, spasmodic coughing after exertion, and a frothy thin fluid in copious amounts streaming from the nostrils. The microscopic findings are identical with those in human adenomatosis. Transmission has been easily effected by keeping healthy and sick sheep housed together, and the disease is generally considered infectious, though the etiologic agent is not known. Cultures have been consistently negative, and virus studies have yielded no positive results. In none of the cases of human pulmonary adenomatosis has there been contact with affected sheep.

The diagnosis of pulmonary adenomatosis should not be difficult if the case presents the usual clinical and roentgenographic features. If the patient complains of dyspnea, cough productive of abundant amounts of mucoid sputum, and weight loss, and if the roentgenogram reveals extensive discrete and confluent nodular densities in the lung fields without hilar or mediastinal adenopathy, the provisional diagnosis should be pulmonary adenomatosis. Bronchoscopy is of considerable help in the diagnosis. The most striking finding in this examination is the tremendous quantity of mucoid sputum aspirated from the bronchi. Exfoliative cytology studies of the aspirated material have not been diagnostic, but further investigation with this method is indicated. An aspiration biopsy of the lung would seem to be the best method of confirming the diagnosis.

The treatment of pulmonary adenomatosis is at the present time purely symptomatic. Lobectomy is probably indicated if the disease is localized in one lobe. Delarue and Graham have reported a case of localized pulmonary adenomatosis in which lobectomy resulted in complete freedom from the disease for a period of four years,

but adenomatosis eventually developed throughout the remaining lung tissue and the patient died. Wood and Pierson have reported a case in which lobectomy was done, after which the patient ran a rapid downhill course with generalized pulmonary adenomatosis and died. We obtained a similar result in one of our cases (Case II). Several cases have had a trial of x-ray therapy, as did Case II in our series. The results have invariably been disappointing, in that there has been no reduction in symptoms or extent of the involvement. While it is true that a tumor lethal dose was not attempted in our case, enough radiation was employed to warrant the statement that the lesion is not radiosensitive.

SUMMARY

1. Benign pulmonary adenomatosis is a rare pulmonary disease of unknown etiology, characterized by a remarkable proliferation of alveolar lining cells throughout large areas of the lungs, by an absence of invasive characteristics, and by an absence of regional or distant metastases.

2. The symptoms of pulmonary adenomatosis are progressive dyspnea, cough productive of copious amounts of thin mucoid sputum, weakness, and weight loss. The disease has been fatal in all reported cases.

3. The roentgenographic findings consist of widespread areas of discrete and confluent poorly outlined nodular densities, with no hilar adenopathy. Serial films show only slow progression of the disease.

Four cases are reported.

REFERENCES

ALEXANDER, C. M., AND CHU, F.: Pulmonary Adenomatosis Complicated by Lobar Pneumonia. Arch. Path. **43:** 92–101, January 1947.

BELL, E. T.: Hyperplasia of the Pulmonary Alveolar Epithelium in Disease. Am. J. Path. **19:** 901–911, November 1943.

BONNE, C.: Morphological Resemblance of Pulmonary Adenomatosis (Jaagsiekte) in Sheep and Certain Cases of Cancer of the Lung in Man. Am. J. Cancer **35:** 491–501, April 1939.

COWDRY, E. V., AND MARSH, H.: Comparative Pathology of South African Jagziekte and Montana Progressive Pneumonia of Sheep. J. Exper. Med. **45:** 571–585, April 1927.

DELARUE, N. C., AND GRAHAM, E. A.: Alveolar Cell Carcinoma of the Lung (Pulmonary Adenomatosis, Jagsiekte?), a Multicentric Tumor of Epithelial Origin. J. Thoracic Surg. **18:** 237–251, April 1949.

DUNGAL, N.: Epizootic Adenomatosis of the Lungs of Sheep: Its Relation to Verminous Pneumonia and Jaagsiekte. Proc. Roy. Soc. Med. **31:** 497–505, March 1938.

GEEVER, E. F., CARTER, H. R., NEUBUERGER, K. T., AND SCHMIDT, E. A.: Roentgenologic and Pathologic Aspects of Pulmonary Tumors Probably Alveolar in Origin, with Report of Six Cases, One of Them Complicated by Torulosis of the Central Nervous System. Radiology **44:** 319–327, April 1945.

GEEVER, E. F., NEUBUERGER, K. T., AND DAVIS, C. L.: The Pulmonary Alveolar Lining Under Various Pathologic Conditions in Man and Animals. Am. J. Path. **19:** 913–927, November 1943.

GRADY, H. G., AND STEWART, H. L.: Histogenesis of Induced Pulmonary Tumors in Strain A Mice. Am. J. Path. **16:** 417–432, July 1940.

HERBUT, P. A.: Bronchiolar Origin of "Alveolar Cell Tumor" of the Lung. Am. J. Path. **20:** 911–929, September 1944.

NEUBUERGER, K. T., AND GEEVER, E. F.: Alveolar Cell Tumor of the Human Lung. Arch. Path. **33:** 551–569, April 1942.

NORRIS, R. F.: Pulmonary Adenomatosis Resembling Jagziekte in the Guinea Pig. Arch. Path. **47:** 553–558, June 1947.

PAUL, L. W., AND RITCHIE, G.: Pulmonary Adenomatosis. Radiology **47:** 334–343, October 1946.

RICHARDSON, G. O.: Adenomatosis of the Human Lung. J. Path. & Bacteriol. **51:** 297–298, September 1940.

SWEANY, H. C.: So-Called Alveolar Cell Cancer of the Lung. Arch. Path. **19:** 203–207, February 1935.

TAFT, E. B., AND NICKERSON, D. A.: Pulmonary Mucous Epithelial Hyperplasia (Pulmonary Adenomatosis). Am. J. Path. **20:** 395–411, March 1944.

WOOD, D. A., AND PIERSON, P. H.: Pulmonary Alveolar Adenomatosis in Man. Is This the Same Disease as Jaagsiekte in Sheep? Am. Rev. Tuberc. **51:** 205–224, March 1945.

WOOD, E. H., JR.: Unusual Case of Carcinoma of Both Lungs Associated with Lipoid Pneumonia. Radiology **40:** 193–195, February 1943.

Methodist Hospital
Memphis 4, Tenn.

(*Para el sumario en español, véase la página siguiente.*)

SUMARIO

Adenomatosis Pulmonar: Presentación de Cuatro Casos

La adenomatosis pulmonar benigna es una afección rara de etiología desconocida, caracterizada por notable proliferación de las células del epitelio alveolar en considerables zonas de los pulmones, por ausencia de características invasoras y por ausencia de metástasis regionales o remotas.

Los síntomas consisten en disnea progresiva, tos húmeda con grandes cantidades de esputo mucoideo claro, extenuación y pérdida de peso. La enfermedad ha resultado mortal en todos los casos descritos.

Los hallazgos roentgenográficos consisten en zonas difundidas de condensaciones nodulares, discretas y confluentes, pero mal definidas, sin adenopatía hiliar. Las radiografías seriadas no revelan más que lento avance de la enfermedad.

Pulmonary Adenomatosis: Further Roentgen Observations[1]

LESTER W. PAUL, M.D., and JOHN H. JUHL, M.D.

Madison, Wis.

THERE CONTINUES to be disagreement as to the place of pulmonary adenomatosis in the classification of neoplasms, the correct nomenclature to be employed, the origin of the basic cell, and even the existence of the condition as a separate entity. Nevertheless, reports on the disease have been appearing with increasing frequency, and further information regarding its nature, clinical course, incidence, and related features has been accumulating. Our discussion will be concerned mainly with the clinical and roentgenologic aspects based on personal observation of 8 cases (4 reported previously and 4 new ones), together with a review of some of the pertinent information to be found in the literature.

In 1945, Paul and Ritchie (7) reported 4 cases of pulmonary adenomatosis and discussed the general features of this relatively uncommon disease in so far as they were then known. At that time the condition had been of interest mainly to pathologists, since the diagnosis had not been made during life (except in 1 case following lobectomy). It was suggested by Paul and Ritchie that in some of these patients a fairly characteristic clinical and roentgenologic pattern might be encountered, from which a correct diagnosis could be made prior to death or before surgical removal of the lung. Further experience has shown this to be the case but has also indicated the value of cytologic study of the sputum in the early recognition of the neoplasm and the inherent difficulty of diagnosis in the early phases on roentgen examination alone.

The most recent review of pulmonary adenomatosis is that of Swan (8). Since he has summarized the literature, no detailed analysis of previous communications will be given here, mention being made only of those having direct reference to the matters discussed.

Because of wide differences of opinion concerning the nature of pulmonary adenomatosis and its relation to alveolar-cell carcinoma of the lung, it is necessary to define the term as we understand it. By some it is used to designate a disease in which there is a widespread hyperplasia of epithelial or epithelial-like cells which cover the alveolar walls in a sheet-like fashion. The process may spread diffusely and widely throughout the lungs or occur in multiple nodular areas with normal lung intervening. There is no tendency for local invasion or metastases. The abnormal cellular lining interferes with gaseous exchange through the alveolar walls; infection is a common complication, and a terminal pneumonia is usually found. Mucus production by the abnormal cells often is pronounced and copious amounts of frothy sputum may be raised. This is the disease represented by the cases of Bonne, Helly, Sims, Bell, and others referred to in the paper of Paul and Ritchie, which resembles jaagsiekte, an infectious disease of sheep.

Among others there is a tendency to include cases in which the basic histologic picture is the same as given above except that local invasion is present, with or without metastases. Many such cases have been described as alveolar-cell carcinomas. Neubuerger and Geever (6) in their review included both forms and termed them "alveolar-cell tumors," thus avoiding any specific designation as to the origin of the tumor cells and without commitment as to the benignancy or malignancy of the lesion.

---

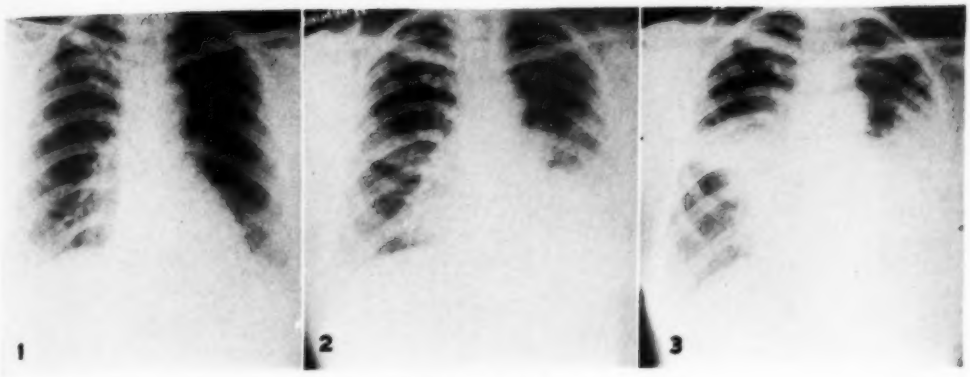
[1] From the Department of Radiology, University of Wisconsin Medical School and State of Wisconsin General Hospital, Madison, Wis. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

Swan preferred the term pulmonary adenomatosis for all types, designating those showing metastases as cancerous adenomatosis. This point of view has other supporters but is denied by some, who prefer to consider alveolar-cell carcinoma a separate entity. Herbut (3) doubts the existence of adenomatosis as a separate tumor but believes that cases so reported represent either adenocarcinoma which has metastasized to the lungs from a distant site or else a form of bronchiogenic carcinoma, arising from the bronchiolar epithelium.

From our own observations we believe that pulmonary adenomatosis is a tumor which may have a variable histologic picture. In its simplest form the lesion behaves pathologically as a benign growth. The cells show a monotonous regularity of form, arrangement, and staining qualities, and careful search reveals no evidence of invasion, metastatic spread, or a possible primary site elsewhere. In this form the disease can be considered relatively rare, probably no more than 15 or 20 such cases having been reported. In other examples the pattern is essentially the same except that study of specimens will show areas of frank carcinomatous change but without demonstrable metastases. In still others, metastases either to the regional nodes or to distant sites will be found. We believe that there is no sharp dividing line between these variable pathologic processes, that the tumor must be considered at least as precancerous, and that pulmonary adenomatosis and alveolar-cell carcinoma, if not the same disease, are at least closely related.

Only a brief summary of some of the controversial points will be given, since they have been covered adequately by Swan in his review. Because of the similarity of pulmonary adenomatosis in man to an infectious disease of sheep known variously as jaagsiekte, epizootic adenomatosis, Montana progressive pneumonia of sheep, etc., most writers on the subject have given considerable attention to this condition and have speculated on the possible relationship of the two diseases. Since all of the evidence indicates that jaagsiekte is an infectious disease, probably due to a virus, while adenomatosis in man behaves like a new growth, it is apparent that a study of the ovine disease might be of interest. Dungal (2), among others, has done considerable investigative work on jaagsiekte and in his most recent report states that man appears to be immune to this particular virus. Hildebrand (4) has reported the first case of human adenomatosis from Montana, a state where jaagsiekte is endemic. The patient had contact with diseased sheep prior to the development of symptoms. No other case of similar nature has been described to the present time. One must conclude that there is no evidence that the disease of sheep can be transmitted to man, and the few attempts to transmit pulmonary adenomatosis of man to laboratory animals have failed. Nothing has been presented thus far to indicate that human adenomatosis is of an infectious origin.

Another controversial point deserves brief mention. This concerns the origin of the cells which distinguish this tumor. Miller (5) and others have contended that normally the alveolar walls are covered by a thin attenuated layer of epithelial cells, either continuous or discontinuous. In the presence of certain pathologic states, as congestion and inflammation, these cells enlarge and proliferate. Others have denied that such cells exist and still others believe that they are present but are of mesenchymal origin. Herbut has championed the belief that the cells found in pulmonary adenomatosis arise from the epithelium of the terminal bronchioles. Ritchie, who examined the specimens from our earlier cases, also inclined toward this view and demonstrated in some of the sections areas where there seemed to be a direct transition from normal bronchiolar epithelium to the cells of adenomatosis. Drymalski, Thompson, and Sweany (1) reported a similar finding. The matter remains in dispute and no unanimity of opinion exists regarding it.



Figs. 1–3. Case I

Fig. 1. Chest roentgenogram taken in December 1944, shortly after the onset of symptoms. There is a slight hazy loss of aeration at the left base.

Fig. 2. Hospital admission roentgenogram, August 1945, nine months after Figure 1. There is extensive consolidation in the left lower lobe, with considerable disease on the right.

Fig. 3. Appearance of the chest six months later, showing extensive progression of the disease.

CASE REPORTS

CASE I: M. R., a white female aged 48, was admitted to the hospital on Aug. 30, 1945, with cough, chest pain, dyspnea on exertion, and chronic fatigue. The cough began nine months prior to admission with an acute episode which was thought to be pneumonia. The symptoms persisted and became worse in April, when a diagnosis of pneumonia was again made. At that time the sputum, which was clear and watery, became copious.

Examination at the time of admission revealed dyspnea with associated slight cyanosis of the nail beds and percussion dullness in the left posterior lung base. Crepitant and bubbling râles were heard over the left hemithorax and the productive cough was noted.

Chest roentgenograms showed a marked density in the basal half of the left lung field, which completely obscured the diaphragm; mottled density was noted in the mid-lung, and the superior third was clear. On the right, a similar homogeneous density was present in the basal third of the upper lobe and a patchy and stringy density was observed to extend from the hilus down along the right cardiac border to the medial base (Fig. 2).

During her hospital stay the patient was afebrile. The twenty-four-hour volume of sputum varied from 240 to 600 c.c. It was always thin and watery, with a floating froth. Bronchoscopy showed the major bronchi to be intensely inflamed; copious amounts of frothy sputum were aspirated during the procedure.

The patient was discharged in September and returned to the hospital on March 4, 1946. During the interval the symptoms had progressed. Physical signs were similar with evidence of more widespread pulmonary involvement. Roentgen examination showed bilateral advance of the disease,

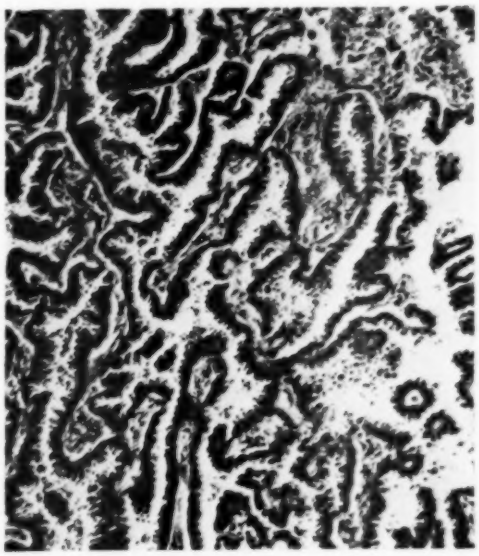
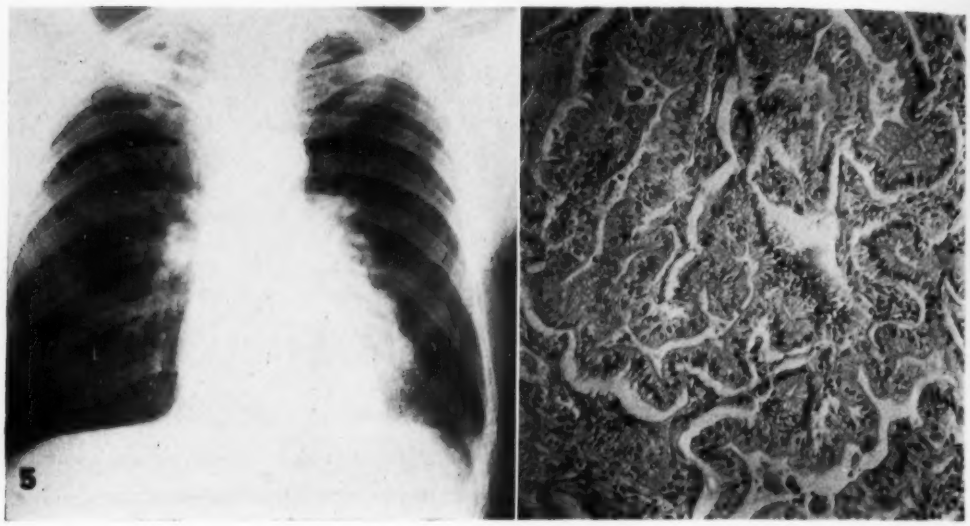


Fig. 4. Case I. Photomicrograph of section of lung removed at autopsy. There is a marked epithelial hyperplasia lining the alveolar walls, with papillary infoldings. The cells are cuboidal or low-columnar in type and remarkably uniform in appearance. There is no invasion of the alveolar septa.

and the findings were felt to be consistent with pulmonary adenomatosis (Fig. 3). Roentgenograms taken before the patient's first admission were made available to us at this time and show the appearance of the process in an earlier phase (Fig. 1).

A lung biopsy was attempted under general anesthesia, but death occurred during the pro-



Figs. 5–6. Case II

Fig. 5. Initial chest roentgenogram, Aug. 13, 1947, showing a zone of homogeneous density in the posteromedial aspect of the left lower lobe.

Fig. 6. Photomicrograph of specimen removed at operation (lobectomy). Except for some difference in staining qualities, the appearance of the cells and other characteristics resemble those in Case I (Fig. 4).

cedure. Autopsy was done on March 18, 1946, and significant findings were limited to the lungs. These organs weighed 1,760 gm. together. There was only a small area of normal appearing lung tissue at the right apex and another at the right base; elsewhere there was involvement by grayish-white tumor tissue. On cut section, nodules of similar character were found in the areas which were thought to be free of disease and the remaining portions of the lungs were completely consolidated, with massive involvement by tumor tissue.

Microscopic examination revealed marked overgrowth of cuboidal to low-columnar cells lining the alveoli; these cells formed papillary processes which extended into many of the alveoli (Fig. 4). Anatomical diagnosis was extensive adenomatosis of both lungs.

Comment: This case represents an example of the "pure" form of pulmonary adenomatosis, in which there was no suggestion of invasion or metastases in spite of the widespread involvement in the lungs. Death occurred as a result of a surgical procedure and thus there was afforded an opportunity to examine the lungs without the complicating factor of pneumonia. Noteworthy in the clinical picture were the large amount of mucoid sputum and the severe dyspnea. It is difficult to see how this case could be designated alveolar-cell carcinoma on the basis of the histology shown. The diagnosis was made prior to death by correlating the clinical and roentgen findings.

CASE II: O. R., a white male aged 67 years, was seen as an outpatient on Aug. 13, 1947, and was admitted to the hospital ten days later. He had been quite well until April 1947, when he developed a cough productive of a cupful of mucoid sputum daily. The cough was severe and persistent. In May 1947, during an episode of chills, fever, and chest discomfort, the sputum became slightly blood-tinged.

On physical examination, pertinent findings were limited to the chest, impaired resonance and many fine and coarse moist râles being noted at the left base.

Roentgen examination on Aug. 13 showed a shadow of homogeneous density paralleling the left cardiac border and extending from the left hilus down toward the base (Fig. 5). It was situated posteriorly, as noted in the lateral view. Bronchography, three days later, was negative for intrinsic bronchial obstruction.

Thoracentesis was done, and abnormal cells were found in the fluid; in addition, similar cells were aspirated at bronchoscopy. Left lower lobectomy was performed on Aug. 29. Examination of the removed lobe showed the major portion to be involved by a peculiar soft process which was pale

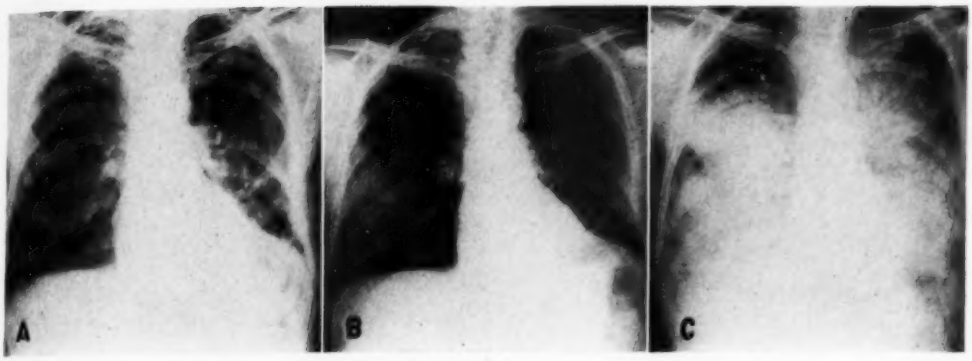


Fig. 7. Case II. Serial roentgenograms after left lower lobectomy demonstrate the progression of the disease. A. Two months after lobectomy there is beginning nodular change in the lower right lung. The haziness in the left is largely a post-surgical residual. B. Five weeks later, the disease has advanced considerably on the right, causing homogeneous nodular and patchy densities. C. Four months later. There now is widespread involvement on both sides, leaving very little aerated lung. Note the similarity in the type of density to that shown in Case I.

gray in color and did not seem to arise from visible portions of the bronchial tree. Histologic sections revealed unremarkable divisions of the bronchi and a chronically inflamed fibrous stroma supporting many regularly spaced, good-sized tortuous acini. The cells were plump, granular, slightly vacuolated, and columnar in type. Some variation in size and chromatin content was noted, but mitotic figures were rare. Tumor cells similar to those in the lung lined the inner surface of the parietal pleura. The histologic diagnosis was alveolar carcinoma with spread to the parietal pleura (Fig. 6).

The patient recovered from the operation and was discharged on Sept. 8, 1947. Since then he has been examined on several occasions. When questioned on April 26, 1948, he was bringing up several pints of clear watery sputum daily. He had lost weight and was dyspneic at rest. A chest film showed increase in homogeneous density bilaterally, with almost complete consolidation throughout the central and basal lung field on the left, leaving aerated lung only along the periphery of the upper lobe. On the right there was an equal advance, with only the upper third of this lung maintaining fairly good aeration (Fig. 7C). The process was felt to be characteristic for widespread pulmonary adenomatosis. No further follow-up has been obtained.

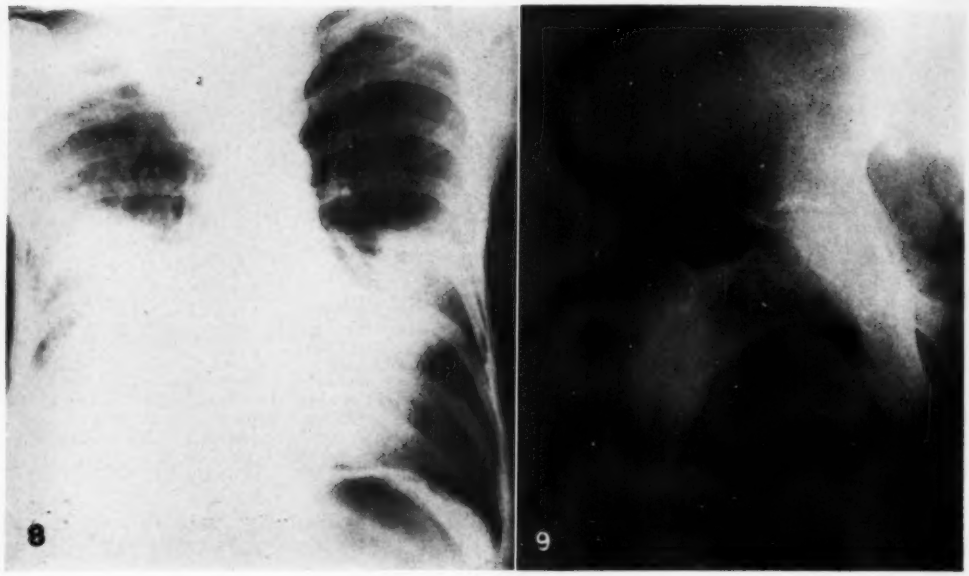
Comment: This tumor represents a form of pulmonary adenomatosis which shows some histologic features of malignancy. The rather marked production of watery sputum is to be noted. The diagnosis of tumor was first made from cytologic examination of the sputum. The course of the disease as shown in the roentgenograms is reasonably typical of adenomatosis. When last seen, the patient was failing rapidly.

CASE III: E. P., a white male aged 42, was admitted to the hospital on Nov. 28, 1947, with pain in the left hip of four months duration. He also had a severe productive cough, with tenacious yellow sputum varying from 6 to 8 ounces daily. Other symptoms included dyspnea at rest, pain in the left shoulder, and swelling over the upper sternum.

Examination revealed severe cachexia and debility, clubbing of fingers and toes, rapid shallow respirations, and tumors over the upper sternum and the left hip. Both were hard but contained fluctuant areas. Pale yellow, cloudy, viscid fluid was aspirated in small amounts from both areas.

A chest roentgenogram taken at the bedside on Nov. 29 showed a rounded mass of soft-tissue density overlying the upper mediastinum. In the basal and central lung fields on both sides there were wedge-shaped areas of conglomerate density of about equal extent. In addition there was a triangular shadow on the right, occupying the medial base, with its upper margin extending obliquely downward from the hilus to the sulcus. The summit of the right diaphragm was vaguely defined and the sulcus was obscured (Fig. 8). Films of the left hip on the same day showed destruction of bone along the outer aspect of the pelvis just above the hip joint, extending well into the wing of the ilium (Fig. 9).

While in the hospital, the patient was given roentgen therapy to the hip in an attempt to relieve pain. Despite symptomatic treatment, his condition became steadily worse and he expired on Dec. 26, 1947. Autopsy revealed malignant adenomatosis of the lung with metastases to the pericardium, hilar nodes, liver, adrenal, sternum, and ilium. The right lower lobe was entirely involved



Figs. 8 and 9. Case III

Fig. 8. Portable roentgenogram of the chest on admission to the hospital. The density overlying the upper mediastinum is due to a large soft-tissue mass involving the anterior chest wall. There is extensive density simulating pneumonic consolidation throughout the lower half of the right lung and in the central third of the left. Death occurred eleven days later.

Fig. 9. Roentgenogram of the left hip, showing an osteolytic lesion involving the outer aspect of the ilium.

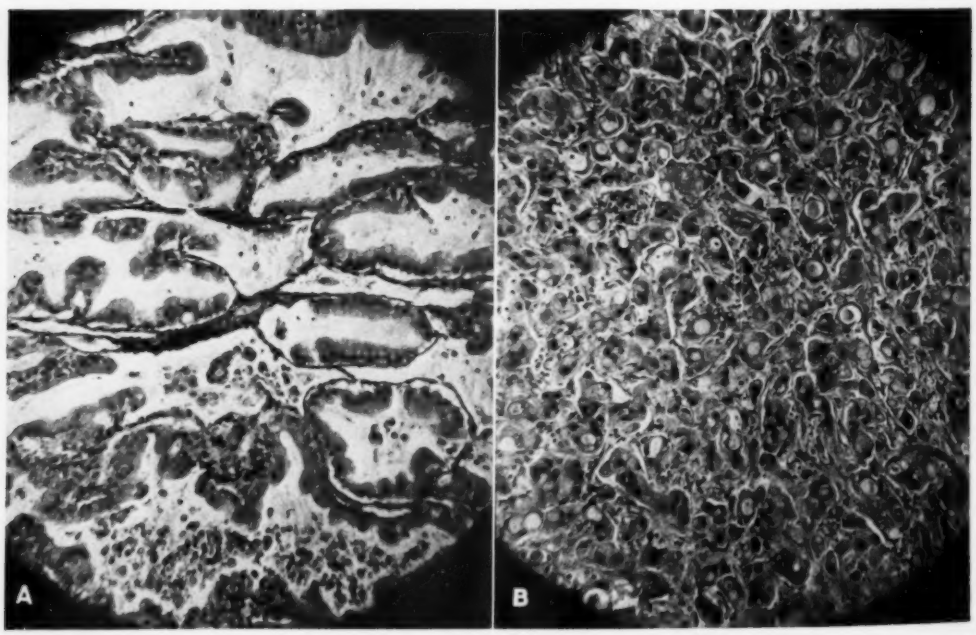


Fig. 10. Case III. A. Photomicrograph of the lung. Normal lung is replaced by papillary tumor tissue. Note pleomorphism of epithelial cells in contrast to uniformity of cells in the other cases. Other sections of the lung showed even greater variation. B. Photomicrograph of metastatic nodule in the liver.

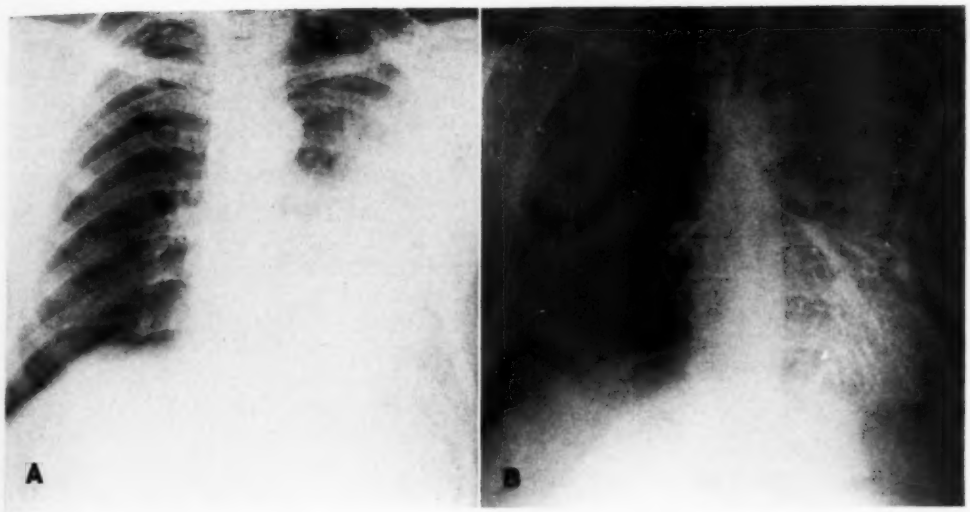


Fig. 11. Case IV. A. Initial roentgenogram, Dec. 13, 1948. There is dense consolidation of the lower two-thirds of the left lung. B. Bronchogram showing at least one small cavity in the area of disease. Other small rarefactions could be seen in overexposed roentgenograms.

by tumor tissue which was firm in consistency. In addition, the lower portion of the upper lobe was involved, leaving the apical portion free of disease. On the left, involvement was confined to hilar nodes. Upon microscopic examination of the tumor, the cell grouping was found to be of an alveolar type, with production of a large quantity of basophilic stringy material. Mitotic figures were common; the cells were columnar in type, and some appeared to be ciliated (Fig. 10).

Comment: This tumor was frankly carcinomatous in areas, and distant metastases had developed; yet, the basic histologic picture was that of adenomatosis. This is the type of lesion often reported in the literature as alveolar-cell carcinoma.

CASE IV: C. S., a white male 42 years of age, was admitted to the hospital on Nov. 20, 1948, with a history of chronic cough productive of whitish-yellow sputum with no blood; the sputum was foamy and thick and would separate into a watery layer and an upper foamy layer upon standing. The patient estimated that he raised approximately a pint of the material in twenty-four hours. There had been a weight loss of 50 pounds in the past two months.

Physical findings included a suggestion of clubbing of the fingers and decreased excursion of the left hemithorax, with percussion dullness over the lower portion of the left lung field.

Roentgen examination of the chest showed homogeneous density obscuring the middle two-thirds of the lung field on the left (Fig. 11A). Bronchography showed multiple cavitations communicating with the bronchi to the lingula, with associated homogeneous density of the lower half

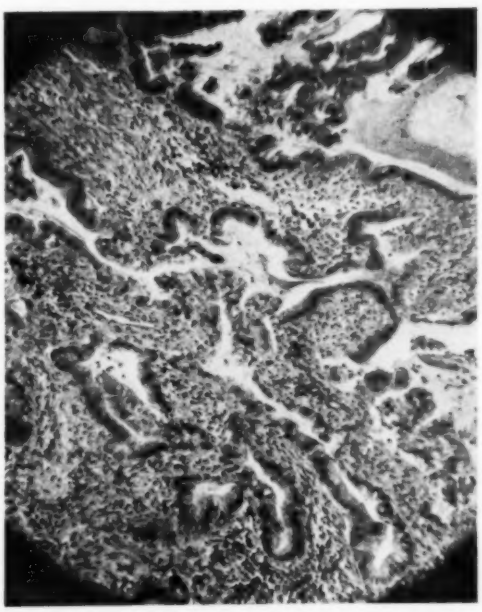


Fig. 12. Case IV. Photomicrograph of specimen from left lung. There is epithelial proliferation similar to that seen in the previous cases; fibrosis and interstitial inflammation are present in greater degree.

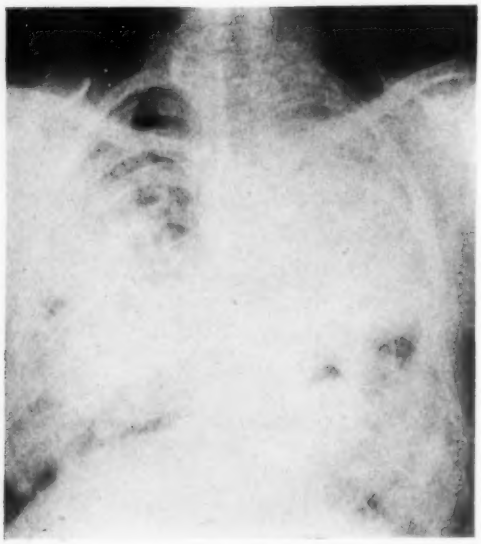


Fig. 13. Case IV. Eight months after left pneumonectomy the right lung is involved extensively.

of the lobe (Fig. 11B). Left pneumonectomy was done on Dec. 15, and after a fairly smooth convalescence the patient was discharged, Jan. 8, 1949.

Examination of the resected lung revealed the middle third to be firm to palpation, with dilated bronchi which were filled with dark red mucoid substance. The firm area represented a somewhat nodular type of consolidation in which the alveoli were lined by cuboidal and columnar cells that were thrown into papillary folds in many areas. The cells had pale cytoplasm with round or oval nuclei, basally placed. No mitotic figures were seen; the alveolar walls were thickened due to increased fibrous tissue. The alveoli not involved by tumor also presented thickening of their walls and varying degrees of bronchopneumonia. The diagnosis was pulmonary adenomatosis (Fig. 12).

The patient was readmitted to the hospital on July 30, 1949. Since his discharge, dyspnea had become increasingly severe; cough had developed, with minimal sputum. Examination revealed signs of widespread consolidation in the remaining lung. A progress roentgenogram confirmed the physical findings, showing a widespread mottled patchy density throughout the remaining lung (Fig. 13). Oxygen therapy was maintained during the hospital stay and the patient was discharged on oxygen and other symptomatic measures on Aug. 17, 1949. No further follow-up has been obtained.

Comment: The histologic picture noted in the surgical specimen is typical of pulmonary adenomatosis. There was a rapid spread of the disease to the opposite lung and the roentgen picture became quite distinctive. Again, in this patient, the volume of sputum raised and its character seem to be highly significant.

DISCUSSION

Clinical Aspects: It is difficult to determine the exact number of cases of pulmonary adenomatosis reported in the literature because of the differences in terminology. Swan lists three criteria as necessary for the diagnosis: (*a*) alveolar cellular proliferation characterized by the appearance of tall columnar, mucus-producing cells; (*b*) absence of an intrinsic tumor of the bronchial tree; (*c*) absence of primary adenocarcinoma in any other part of the body. Rejecting all cases which did not meet these requirements, he found 52 acceptable examples in the literature. Of these, approximately one-half showed evidence of metastasis either to the regional nodes or to distant sites. Swan added 9 examples of the disease to this list from the Army Institute of Pathology. It is of some interest that 2 of his cases do not meet all of the criteria proposed by him as necessary for the diagnosis of adenomatosis, since the diagnosis was based on examination of a lung removed surgically without the benefit of autopsy, and a primary adenocarcinoma in some distant organ obviously could not be excluded. This merely emphasizes the difficulty in determining which of the cases recorded in the literature should be included as true instances of pulmonary adenomatosis.

It is apparent that the disease, in the broadest sense, is not rare, and that only when cases are limited to those showing no evidence of carcinomatous change, as in our Case I, does it approach the status of the unusual. If malignant variants are included, published statistics indicate that pulmonary adenomatosis makes up from 1 to 5 per cent of all pulmonary new growths.

Until recently, most of the reported cases were not diagnosed until autopsy, and many were not studied clinically until the patients were in the terminal stages.

when infection complicated the picture. The following remarks on the clinical and roentgenologic features are a composite of our own observations and those described by others.

Pulmonary adenomatosis occurs with about equal frequency in males and females. Thus it differs significantly from bronchogenic carcinoma, in which published statistics show a preponderance of males over females—three to ten males to one female. The majority of cases have occurred between the ages of forty and seventy. The disease may begin insidiously or have an abrupt onset. Often it is ushered in with an acute febrile episode, leading to a diagnosis of pneumonia. The duration has been variable. In some patients the disease has run a rapid course, with death within a few months. In others, progress has been slow, with symptoms dating back a matter of years. In one of our earlier cases the patient had noted progressively increasing dyspnea for approximately seven years. The chronicity of the disease in some instances indicates the need for caution in interpreting the results following lobectomy or pneumonectomy.

Cough and shortness of breath are the two most prominent symptoms. The cough may be dry but more often is productive. The sputum is usually of mucoid type and the quantity raised may be enormous. In one of our patients it amounted to as much as 600 c.c. in twenty-four hours. Others have reported instances in which the cough was productive of large amounts of frothy sputum, and when present this seems to be a highly significant observation. Blood streaking has been reported occasionally, more often in the late stages of the disease, and in some it seems to have been related to a terminal pneumonia. Gross hemorrhage has not occurred in any of our cases. Some of the case histories in the literature mention hemoptysis but are not clear as to the amount of bleeding. It is concluded that frank hemorrhage is unlikely unless carcinoma has developed. Dyspnea seems to be another significant symptom. It is mentioned as a prominent feature in many of the case histories. Frequently it was the initial symptom. In some patients it was of extreme degree and in late stages of the disease such simple effort as turning over in bed caused severe shortness of breath. The remaining symptoms—loss of weight and strength, fever, anorexia, etc.—are common to many diseases and do not appear to have any diagnostic significance.

Recently the possibility of making the diagnosis from a study of the cellular elements in the sputum has received some attention. In our Case II, abnormal cells were found at several examinations. It seems likely that more cases will be recognized in early stages if this method of examination is utilized when clinical and roentgen signs suggest the possibility of this condition.

At the present time there seems to be no method of treatment which will halt the spread of the disease. There is no convincing evidence that radiation therapy is effective, although the number of instances in which it has been tried is not large enough to allow a positive answer. Surgical removal of a lobe or an entire lung may be worth while in giving palliation, and the possibility of cure still exists, although there is little support in the literatune for this assumption. In our Case II, the disease made its appearance in the opposite lung within some six weeks after removal of the lobe originally affected. In Case IV, roentgenograms showed an extensive spread in the opposite lung eight months after pneumonectomy.

Roentgen Features: When seen early, the lesion has been limited to one lung. The most common appearance is that of a zone of homogeneous increase in density of variable size, occupying less than a single lobe and having hazy, ill-defined boundaries. It resembles in most respects a patch of pneumonic consolidation. There is no enlargement of hilar lymph nodes and no pleural reaction. Atelectasis is not apparent. In a few instances, the original focus has shown central cavitation when first seen, leading to the diagnosis of a lung

abscess. Bronchography in some cases has shown nothing of interest. In a few (and it has not been a frequent procedure), terminal bronchial dilatation suggesting bronchiectasis or small abscess formation has been found (Case IV). In other cases, cyst-like spaces within the area of disease have been described in autopsy protocols. In the majority, however, no cavitation, bronchial dilatation, or bronchial obstruction is seen. If the affected lobe or lung is removed, almost without exception the disease makes its appearance within a relatively short time in other and previously normal appearing parts of the lungs, either as single areas of consolidation or several such areas separated by normally aerated parenchyma. These enlarge and may coalesce and if the patient survives long enough practically all of the lung may appear to be consolidated. One must conclude that, even in apparently early cases, other foci of neoplastic tissue exist but are of insufficient size to be detectable roentgenographically.

In correlating roentgenograms with autopsy specimens, we have been impressed by the fact that areas of disease may be present and even fairly widespread without detectable roentgen changes and that in most cases microscopic examination of the lungs will show more extensive disease than would be suspected from the films. Apparently a simple covering of the alveolar walls by alveolar-cell hyperplasia is not enough to give positive evidence of increased density. More likely, there is required, in addition, a filling of the alveolar spaces with exudate or extensive papillary projections of the tumor tissue before appreciable loss of aeration is evident. In fact, the outpouring of mucus must account for much of the density seen in some cases.

In those patients not subjected to surgical procedures the picture has been one of wide dissemination, usually in both lungs. Hazy infiltrative shadows develop, gradually increase in size, and coalesce, leaving relatively small amounts of normal lung. The added factor of infection complicates the picture, and a pneumonia may be superimposed without any way of determining, roentgenologically, how much of the density is pneumonic and how much neoplastic.

A less common form of the disease is seen as multiple, ill defined nodules scattered indiscriminately throughout the lungs. Some of the lungs which show a diffuse type of lesion roentgenologically will appear to have a predominantly nodular pattern on gross and microscopic examination. We feel that this is due to the superimposition of nodules in the roentgenogram, to infection in the adjacent lung, and probably to retention of mucus in normal alveoli from adjacent tumor areas. Thus roentgenographically demonstrable nodularity is a distinctly less common form of the disease than would appear from the autopsy protocols. In those cases with metastases, death may result before widespread invasion of the lungs has occurred, and symptoms referable to the metastatic growths may be a part of the clinical picture (Case III). Involvement of the pleura may also occur in the later stages.

The diagnosis of adenomatosis can hardly be made from a single roentgen observation. Most commonly the lesion or lesions have the appearance of pneumonic consolidation. Serial studies will show, as a rule, a slow progression, so that over a period of weeks or months there is a gradual enlargement of these areas and appearance of new foci. In a few cases, apparent shrinkage or at least fluctuation in size of the lesions has been described. Probably this represents only a clearing of inflammatory changes, since it is doubtful if spontaneous regression of the neoplastic tissues occurs. The observer of serial studies soon is made aware that he is dealing with more than a simple pneumonic process. If the patient shows signs of increasing dyspnea and has a cough productive of large amounts of frothy mucoid sputum, the diagnosis of pulmonary adenomatosis should be entertained.

SUMMARY AND CONCLUSIONS

1. Four cases of pulmonary adenomatosis are reported and a brief discussion of the controversial points concerning this disease is given.

2. In our opinion the disease may show a variable pathologic picture. In its simplest form it resembles a benign growth in all respects; dyspnea and cough productive of large amounts of watery sputum are significant findings; and death results from interference with the normal functions of the lungs and from complicating infection. In other cases the basic histologic picture is the same, but study of surgical or autopsy specimens will show areas of frank carcinomatous change and, in some, distant metastases.

3. The most common roentgen appearance is that of single or multiple areas of homogeneous density resembling pneumonic consolidation. Atelectasis is not apparent, and there is no evidence of mediastinal lymphadenopathy or of involvement of the pleura. Serial observations over a period of time (usually a matter of months) will show a slow progression of the disease until finally little normally aerated lung remains. Less frequently a nodular type of the disease is found, which resembles metastatic carcinoma in its roentgen features.

4. Cytologic study of the sputum may give a clue to the diagnosis in some cases.

5. No method of treatment has been successful in curing the disease. Lobectomy or pneumonectomy may give worthwhile palliation, but all of the evidence indicates that the tumor is of multicentric origin and that, even when it is apparently localized to one lobe, other foci of neoplastic growth probably exist.

1300 University Ave.
Madison 6, Wis.

REFERENCES

1. DRYMALSKI, G. W., THOMPSON, J. R., AND SWEANY, H. C.: Pulmonary Adenomatosis. Am. J. Path. **24:** 1083–1093, September 1948.
2. DUNGAL, N.: Experiments with Jaagsiekte. Am. J. Path. **22:** 737–759, July 1946.
3. HERBUT, P. A.: Bronchiolar Origin of "Alveolar Cell Tumor" of the Lung. Am. J. Path. **20:** 911–929, September 1944.
4. HILDEBRAND, E.: Pulmonary Adenomatosis. Am. Rev. Tuberc. **57:** 281–286, March 1948.
5. MILLER, W. S.: The Lung. Springfield, Ill., Charles C Thomas, 1937, p. 62.
6. NEUBUERGER, K. T., AND GEEVER, E. F.: Alveolar Cell Tumor of the Human Lung. Arch. Path. **33:** 551–569, April 1942.
7. PAUL, L. W., AND RITCHIE, G.: Pulmonary Adenomatosis. Radiology **47:** 334–343, October 1946.
8. SWAN, L. L.: Pulmonary Adenomatosis of Man. Arch. Path. **47:** 517–544, June 1949.

SUMARIO

Adenomatosis Pulmonar: Nuevas Observaciones Roentgenológicas

Al presentar 4 casos de adenomatosis pulmonar, ofrécese una reseña de los puntos en disputa con respecto a la dolencia.

Opinan los AA. que la enfermedad puede revelar un cuadro patológico variable. En su forma más sencilla, se parece en todos sentidos a un tumor benigno; la disnea y la tos húmeda con grandes cantidades de esputo acuoso constituyen hallazgos significativos. En otros casos, el cuadro histológico básico es idéntico, pero el estudio de ejemplares quirúrgicos o autópsicos muestra zonas de franca carcinomatosis y, en algunos casos, metástasis remotas.

El aspecto roentgenológico más común consiste en zonas únicas o múltiples de condensación homogénea que semejan hepatización. No hay atelectasia manifesta ni signos de linfadenopatía mediastínica o de invasión de la pleura. Las observaciones en serie durante cierto período de tiempo (por lo general meses) revelan lento avance de la afección hasta que por fin queda bien poco tejido pulmonar normalmente aireado. Con menos frecuencia obsérvase una forma nodular de la enfermedad, cuyas características roentgenológicas semejan las de las metástasis carcinomatosas.

El estudio citológico del esputo puede, en algunos casos, ofrecer una clave al diagnóstico.

Ningún método terapéutico ha tenido éxito curativo.

Hamartoma of the Lung

The Improbability of Preoperative Diagnosis[1]

WILLIS E. LEMON, M.D.
Fellow in Radiology, Mayo Foundation
and
C. ALLEN GOOD, M.D.
Section on Roentgenology, Mayo Clinic
Rochester, Minn.

IN THE PAST SIX years, at the Mayo Clinic, 17 hamartomas of the lung have been removed surgically and the diagnosis has been made subsequently by microscopic examination of the tissue. Since, so far as we know, this is the largest series of these tumors to have been observed clinically and surgically, we believed that an attempt should be made to determine whether diagnosis could be made prior to surgical removal of the lesion. We felt particularly responsible for determining what roentgenography could contribute to such diagnosis. The microscopic sections and roentgenograms representing each of the 17 cases were reviewed.

PARTIAL SURVEY OF REPORTED EXPERIENCE

Definition and Classification: The term "hamartoma," from the Greek word meaning "to err," was originated by Albrecht (1) in 1904. His definition, in translation, is "tumor-like malformations in which in truth one can demonstrate only an abnormal mixture of the normal developmental components of the organ in which they occur, whether it be with regard to the quantity, to the arrangement, or to the degree of development, or in all three respects. The conclusion that can be drawn from such a histologic analysis of these structures is evident; it should be assumed that their origin likewise results from such an abnormal mixture or from disturbances of their development." Albrecht used this term to explain cavernomas of the liver, cavernomas of the spleen, and tubular adenomas of the liver, and suggested its application to a great many benign tumors. At the present time, the designation "hamartoma" is applied to the benign tumors of the bronchus which are the subject of this paper and, in addition, to specific benign tumors in other organs. Prior to Albrecht's work, and before the term was more widely accepted, hamartomas of the lung were frequently described as chondromas (2–4). Jaeger (5) used the term "hamartochondroma" to specify the dominant element.

In 1938, Womack and Graham (6) included chondromas of the lung under the general designation "mixed tumor of the lung." Cid (7), writing in 1940 of pulmonary hamartochondromas, considered chondroma to be one of the choristoblastomas and classified adenomas and hamartochondromas as varieties of hamartoma. McDonald (8), however, has not included pulmonary adenomas among the hamartomas.

In 1948, Hall (9) contributed reports of 4 new cases of pulmonary hamartoma and stated that the total number of reported cases of chondroma and hamartoma was more than 100. With the addition of 14 of the 17 cases described herein (3 of the 17 cases having been previously reported by McDonald, Harrington, and Clagett, 10) the total is probably in the neighborhood of 120 or 125.

Situation: The distribution of the lesions in the lung demonstrates no clear predilection for either side nor for upper or lower

---

[1] Abridgement of a thesis submitted by Dr. Lemon to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Radiology. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio. Dec. 4–9, 1949.

lobes (4, 10). The tumors usually are just subpleural, although they have been found in nearly every possible relation to the pleura. Most of those in the McDonald, Harrington, and Clagett series were subpleural, at the costal surface, interlobar surface, or diaphragmatic surface of the lung; 3, however, were hilar in location. In 3 of the cases reviewed by Verga (4), the tumor was suspended in the pleural cavity by a pedicle.

Gross Pathologic Characteristics: The macroscopic appearance of hamartomas (or hamartochondromas) is rather typical. In size, there is great variation. Verga found that in the reported cases the tumor varied from the size of a "peppercorn" to that of "an adult's head." He stated that growths of medium size predominated. The mass is usually spherical or oval. It is firm, with a rough, nodular surface, and frequently grayish white. It is usually encapsulated, is but loosely attached to the surrounding pulmonary tissue, and can be enucleated easily.

Histopathologic Characteristics: The microscopic appearance of these lesions has been similarly described by most authors. Cartilage is the predominant tissue and may be hyaline, fibrous, or elastic, arranged in islands, and possessing a perichondrium. This cartilage may have undergone calcification in part, transformation into bone, or degeneration. Between the cartilaginous islands is connective tissue, frequently myxomatous, containing the other elements associated with these lesions. The epithelium represented may be cuboidal, columnar, or flattened; it may be ciliated, and it lines tubular or cyst-like structures which may contain mucus. Smooth-muscle fibers may be found. Fat is present in many of the tumors (3, 4, 10). Hall wrote: "Thus it is seen that these tumors contain representatives of the histologic elements which make up mature bronchi or lung tissue, although all these elements are not present in every hamartoma."

It has been suggested that hamartomas may undergo malignant change. Verga noted a tendency to invasion in one of his cases and cited other instances in which metastasis had occurred.

Incidence, Sex, and Age: McDonald, Harrington and Clagett reported 20 cases of hamartoma in a series of 7,972 necropsies, an incidence of 0.25 per cent. In their series of 23 cases, 17 of the patients were men and 6 were women; a ratio of men to women of nearly 3 to 1. These figures seem to indicate a distinct sex difference in occurrence. From published experience (4, 10) it appears that a patient may be of practically any age when hamartoma is discovered. More of the tumors are found among elderly than among young persons, however, because so many are discovered at necropsy and more elderly than young people come to postmortem examination.

Symptoms: There are no pathognomonic symptoms of hamartoma of the lung. This, of course, is because the tumors frequently are in the periphery of the lung and therefore do not involve bronchi. Sherwood and Sherwood (11) noted that the three symptoms most frequently observed were cough, pain, and dyspnea, their development depending on the size and the situation of the growth. Tumors near the periphery caused early pain, and those near the hilus and occluding a bronchus brought about early development of cough and dyspnea. The tumor may obstruct the superior vena cava or its branches, or may cause exophthalmos by pressing on the sympathetic chain.

Roentgen Characteristics: Because of the frequent lack of symptoms, the tumors, aside from those accidentally discovered at necropsy, are unexpected findings in the course of routine roentgen examination of the thorax. Hickey and Simpson (3), Benninghoven and Peirce (12), Hall (9), and others have established roentgenographic diagnostic criteria on which an opinion can be based. The usual chondroma, or hamartochondroma, appears as a dense shadow. Hall wrote: "Small calcifications scattered through a discrete, smooth-margined, round or lobulated mass which is surrounded by normal lung tissue is sufficiently unusual to suggest at once the

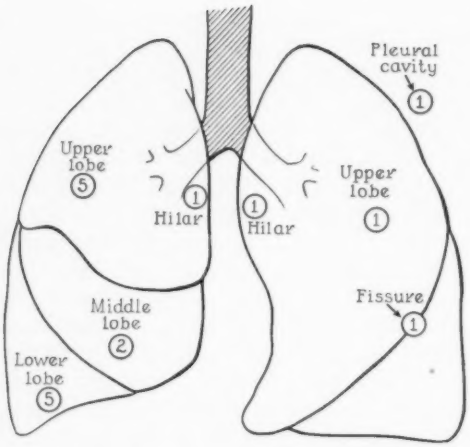


Fig. 1. Situation of 17 hamartomas of the lung.

possibility of hamartoma." The areas indicating increased density, of course, may represent ossification as well as calcification.

EXPERIENCE IN SEVENTEEN CASES

As has been said, 3 of the 17 hamartomas of the lung to be considered here were reported by McDonald, Harrington and Clagett in 1945. The other tumors in their series were discovered at necropsy and are excluded from this paper for that reason.

Situation: The distribution of the lesions is indicated in Figure 1. Thirteen were on the right side and only 4 on the left side. Findings not evident in Figure 1 are as follows: the one tumor that lay in a fissure was near the left hilus. One tumor occupied almost the entire right lower lobe. Three tumors were described as lying deep in the substance of the lung, and 7 were described as lying close to fissures or in a subpleural location. In 2 cases the situation of the lesion within the lobe of the lung was uncertain.

Pathologic Characteristics: In 11 of the 17 hamartomas evidence of calcification or ossification was demonstrable on either macroscopic or microscopic examination; in 6, such evidence was not found.

Comparison, in certain particulars, of results of pathologic and of roentgen examination may be of some value. In a later paragraph it will be related that in 7 of the 17 cases calcification was not roentgenographically demonstrable; in 5 of these, evidence of calcification was not found in examination of the actual specimen. It will be stated, further, that in each of 4 cases there existed roentgen evidence of a lesion containing small areas of increased density but that the roentgenographic density and clarity were insufficient to justify the inference that calcification had taken place within the lesion. Nevertheless, on examination of the 4 tumors themselves, calcified tissue was found in 3.

Fig. 2. Section of a hamartoma of the lung demonstrating cartilage, epithelial-lined clefts, smooth muscle fibers immediately beneath epithelium, myxomatous connective tissue, and fat. Hematoxylin and eosin. ×65.

Study of the microscopic sections in the 17 cases revealed that 15 of the lesions could be classified as hamartochondromas because of the presence of cartilage in addition to other characteristic elements. The epithelium lining the cleft-like spaces within

the lesions varied in type; flattened, cuboidal, and ciliated columnar cells were seen, although not all were present in each tumor, and in 2 tumors epithelium was not discovered. Other elements—smooth muscle, fat, bone, collections of lymphocytes, and connective tissue—also were seen, but again not all were present in any one tumor. All of the 15 lesions demonstrated the mixture of mesodermal and entodermal elements characteristic of hamartoma of the lung (Fig. 2).

Two of the lesions were more difficult to diagnose from the standpoint of tissue change. One of these, a tumor which did not resemble the usual hamartoma in gross appearance, had occupied a position in the lung close to the hilus (Fig. 3). Microscopic examination showed chiefly myxomatous fibrous tissue, with a small amount of ciliated epithelium. The absence of cartilage excluded the diagnosis of hamartochondroma. The lesion, however, was probably a hamartoma, with predominance of fibrous tissue.

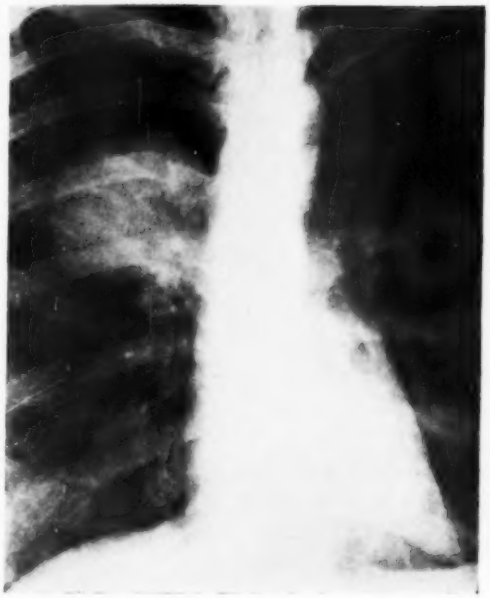


Fig. 3. Hamartoma of the lung which contained no calcified tissue. This lesion was not a hamartochondroma and was composed almost entirely of myxomatous fibrous tissue. (Reprinted, with permission, from McDonald, Harrington, and Clagett, 10.)

The second atypical hamartoma presented an even greater problem of classification. It was finally decided that this tumor (Fig. 4), because of the presence of a bronchial type of epithelium and elements of mesodermal origin, including an area of hemangioma-like tissue, was a hamartoma according to the definition of Albrecht. Further classification has not

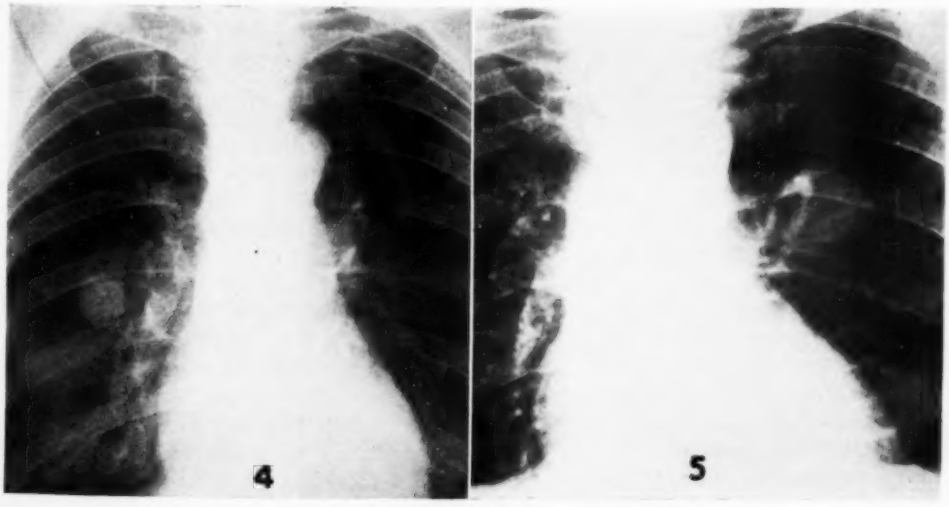


Fig. 4. No evidence of calcification within the lesion.
Fig. 5. Evidence of a few small flecks of calcified tissue, only suggestive of the presence of hamartoma.

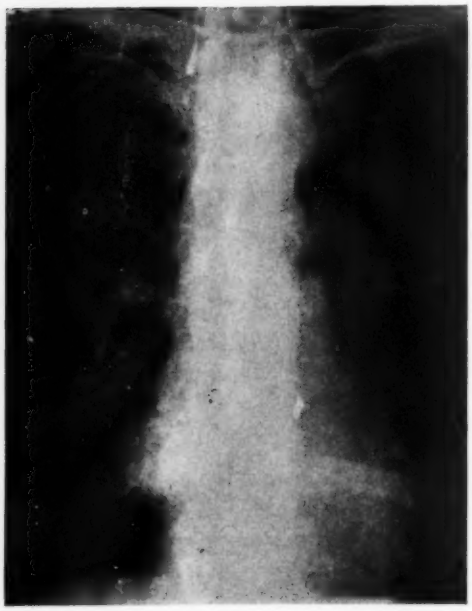


Fig. 6. Evidence of multiple flecks of calcification in center of lesion, regarded as rather characteristic of hamartoma. (Reprinted with permission, from McDonald, Harrington, and Clagett, 10.)

been reached. The tumor was entirely different from any other in the series and, so far as has been determined, different from the hamartomas previously described.

Sex and Age: Eleven of the patients were men and 6 were women, a ratio of nearly 2 to 1. The average age of the men was approximately forty-five years; of the women, approximately fifty years; of the entire group, about forty-seven years. The range in age was from twenty-one to sixty-two years.

Symptoms: Four patients were free of symptoms. The complaints of 3 patients could have been attributable to another agent, such as a known serious pulmonary disease. Thus, in 7 cases the hamartoma can be considered to have been a silent lesion.

Symptoms of the other 10 patients probably were attributable to the presence of the hamartoma. Cough was the only symptom in 5 cases but was present in 8 cases. Six patients complained of thoracic pain, but in 4 of these the pain was more readily ascribed to other causes; thus, in only 2 cases could pain be regarded as a presenting symptom. Four patients complained of exertional dyspnea with or without cough, pain, or both. In 1 of these 4 cases the hamartoma had caused distortion of a bronchus; multiple emphysematous blebs were present in another, but in the remaining 2 the dyspnea remained unexplained.

The symptoms noted in the series, after exclusion of those apparently attributable to processes other than hamartoma, were, in order of frequency, cough, dyspnea, and pain, although it is to be remembered that approximately a third of the patients could be regarded as symptom-free. Since the symptoms observed are so commonly manifestations of other diseases, they could not serve as a basis of diagnosis.

Roentgen Characteristics: Emphasis has been placed on the evidence of calcification within the roentgenographic shadow of the lesion. Hall wrote: "Large hamartomas which contain calcium or bone can be diagnosed with reasonable accuracy from roentgenograms alone." Roentgen evidence of calcification was absent in 6 of our cases in which the lesion cast a shadow. In 1 case the lesion itself was not roentgenographically visible, being discovered only at pneumonectomy performed for another reason. Thus, in 7 cases of the 17 (41 per cent) calcification was not demonstrable in the roentgenograms.

In each of 4 cases, the roentgenogram included the shadow of a lesion, and this shadow contained small indistinct areas suggesting the presence of tissue of increased density. These areas, however, were not indicative of sufficient density, nor were they of sufficient clarity, to be considered to represent calcification.

In each of 2 cases, a lesion cast a roentgenographic shadow which contained small areas that could be interpreted as calcification. These areas, however, were few and small. The roentgenogram in one of these cases is reproduced in Figure 5. The appearance of these lesions seems not to be that which is described in the literature as characteristic of pulmonary hamar-

toma, in that the calcification is insufficient in amount. However, the presence of calcification in the central portion of the lesion is suggestive of the presence of hamartoma.

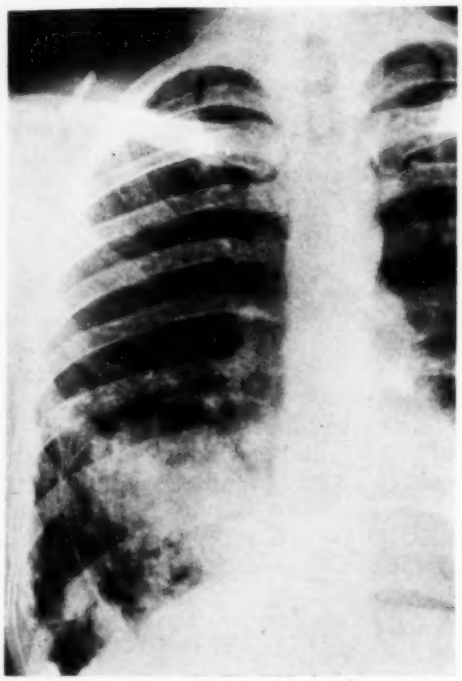


Fig. 7. Cyst-like appearance and unusual size of lesion, not characteristic of hamartoma.

Two lesions gave a roentgen appearance fairly typical of hamartoma. There were multiple, discrete, irregular areas characteristic of calcification within the central portion of a roughly round shadow of which the periphery was somewhat irregular (Fig. 6). Judging from the statements of previous authors, the roentgenologic diagnosis of hamartoma of the lung could be made with reasonable certainty in these 2 cases.

In 1 case the roentgen appearance resembled a bilocular cystic process, containing calcified tissue as well as tissue of decreased density, and possessing a smooth, dense border. The lesion occupied almost an entire lobe of a lung (Fig. 7). This

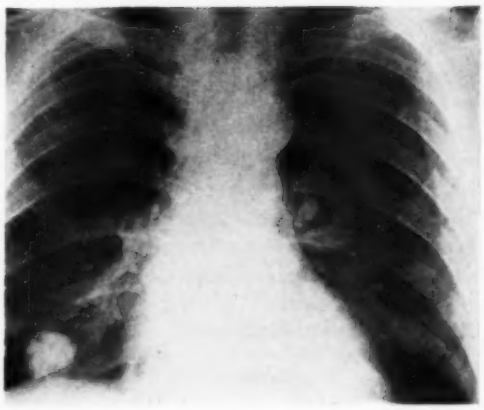


Fig. 8. Evidence of excessive calcification, not characteristic of hamartoma.

picture is not suggestive of hamartoma in the limited sense of the word (hamartochondroma), because of the cystic appearance and because of the unusual size of the lesion.

In 1 case, the entire lesion seemed to be calcified, although, on close inspection of the roentgenogram, the appearance was that of a lesion composed of many pieces of calcified tissue packed closely together (Fig. 8). This appearance can be regarded as suggestive of the possibility of hamartoma, but it could not be regarded as characteristic.

To summarize the roentgenographic data: 11 (64.7 per cent) of the 17 lesions gave either no roentgen evidence of calcification, or evidence insufficient to permit the assumption that calcification had taken place within the lesion. These lesions, then, demonstrated no characteristic to permit the diagnosis of hamartoma in preference to any other process which could cause a discrete solitary area of increased density in a roentgenogram of the thorax. Three of the 17 lesions gave evidence of calcification, but the roentgen appearance varied sufficiently from that previously described as characteristic of hamartoma to allow only a suggestion of the possibility of that lesion. Two of the lesions, it was decided, gave a roentgen appearance identical with previously des-

cribed cases. One lesion, which gave evidence of calcification, still was roentgenographically so unlike the hamartomas reported by others that the possibility of that diagnosis could not be suggested.

It is apparent that the diagnosis of hamartoma, in the majority of the cases of this series, could not be strongly suspected from the roentgen appearance of the lesions. In only 5 of the 17 lesions could the possibility or probability of the diagnosis of hamartoma be mentioned.

COMMENT

There remain to be considered three other diagnostic procedures, the first of which is bronchoscopy. With a single exception, in which distortion of a bronchus occurred, the lesions in our series had no demonstrable connection with a bronchus. Bronchoscopy, therefore, would have been of little aid to diagnosis.

Johnson, Clagett and Good (13) discussed the importance of exploratory thoracotomy in diagnosis of this type of lesion and stated: "After a thorough study of the roentgenograms in these cases in which mass lesions presented, it was apparent that no definite criteria could be found to distinguish one type of lesion from another. In fact, a striking similarity was noted in the roentgenographic appearance of various types of benign and malignant lesions." Seventy-four per cent of their series of lesions, represented roentgenographically by the shadow of an abnormal mass, were proved at operation to be malignant. They concluded that the presence of a mass of indeterminate nature is an indication for exploratory thoracotomy.

Cytologic study of bronchial secretions in the diagnosis of pulmonary carcinoma is becoming increasingly important. It would be fortunate if a benign lesion, such as hamartoma, could be strongly suspected to be present because of the absence of malignant cells in the bronchial secretions or sputum, but this is not the case. Recent studies by Woolner and McDonald (14) of diagnosis of carcinoma of the lung by cytologic study of sputum or bronchial secretions have indicated that "there is a group of cases of peripherally situated carcinomas, frequently of the adenocarcinoma type, in which no, or very minimal, communication with the bronchial tree can be traced and in which the cytologic findings will be fairly consistently negative." If a negative cytologic examination cannot be relied on to distinguish benign from malignant lesions, again exploratory thoracotomy becomes necessary for diagnosis.

SUMMARY

In the past six years, at the Mayo Clinic, 17 hamartomas of the lung have been removed surgically and the diagnosis has been made subsequently by microscopic examination of the tissue.

Thirteen of the tumors were found on the right and 4 on the left side; 7 lay close to fissures or were subpleural. In 15 of the cases the tumors contained cartilage and some of the other characteristic tissues: epithelium, smooth muscle, fat, bone, lymphocytes, and connective tissue. In 2 of the cases, diagnosis even by examination of tissue was difficult.

Among the 17 patients, the ratio of men to women was nearly 2 to 1; the average age was approximately forty-seven years and the range in age from twenty-one to sixty-two years. Symptoms were not helpful in diagnosis; moreover, in only 5 cases could a possibility or probability of the diagnosis of hamartoma be based on roentgenographic grounds. There seems no likelihood that bronchoscopy would have been of diagnostic value, nor would cytologic examination of sputum have excluded the possibility of carcinoma. Study of the 17 cases did not disclose a diagnostic alternative to exploratory thoracotomy.

Experience in the 17 cases accorded generally with that of others, except that in these cases roentgenographic findings were less characteristic than some other investigators have considered them to be.

REFERENCES

1. ALBRECHT: Ueber Hamartome. Verhandl. d. deutsch. path. Gesellsch. **7:** 153–157, 1904.
2. MCGLUMPHY, C. B.: A Special Form of Chondroma of the Lung. J. Cancer Research. **8:** 482–498, 1924.
3. HICKEY, P. M., AND SIMPSON, W. M.: Primary Chondroma of the Lung: a Roentgenological and Pathological Study Based Upon an Analysis of Forty Cases, with a Report of Two New Cases. Acta radiol. **5:** 475–500, 1926.
4. VERGA, P.: I condromi del polmone. Pathologica **24:** 1–22, 1932.
5. JAEGER, L.: A propos de quelques cas de "chondromes pulmonaires." (Les hamartomes pulmonaires: hamartochondromes et hamarto-kystomes). Ann. d' anat. path. **12:** 811–822, 1935.
6. WOMACK, N. A., AND GRAHAM, E. A.: Mixed Tumors of the Lung: So-called Bronchial or Pulmonary Adenoma. Arch. Path. **26:** 165–206, 1938.
7. CID, J. M.: Hamarciocondromas pulmonares. An. de cir. **6:** 285–297, 1940.
8. MCDONALD, J. R.: Personal communication.
9. HALL, W. C.: Roentgenologic Significance of Hamartoma of the Lung. Am. J. Roentgenol. **60:** 605–611, 1948.
10. MCDONALD, J. R., HARRINGTON, S. W., AND CLAGETT, O. T.: Hamartoma (Often Called Chondroma) of the Lung. J. Thoracic Surg. **14:** 128–143, 1945.
11. SHERWOOD, K. K., AND SHERWOOD, H. H.: Enchondromata of the Lung, with Report of a Fatal Case. Journal-Lancet **52:** 395–398, 1932.
12. BENNINGHOVEN, C. D., AND PEIRCE, C. B.: Primary Chondroma of the Lung. Am. J. Roentgenol. **29:** 805–812, 1933.
13. JOHNSON, C. R., CLAGETT, O. T., AND GOOD, C. A.: Importance of Exploratory Thoracotomy in the Diagnosis of Certain Pulmonary Lesions. Surgery **25:** 218–230, 1949.
14. WOOLNER, L. B., AND MCDONALD, J. R.: Cytologic Diagnosis of Bronchogenic Carcinoma. Dis. of Chest **17:** 1–10, 1950.

Section on Roentgenology
Mayo Clinic
Rochester, Minn.

SUMARIO

Hamarcioma Pulmonar

En los últimos seis años, en la Clínica Mayo, han extirpado quirúrgicamente 17 hamarciomas del pulmón, haciéndose el diagnóstico después por el examen microscópico del tejido.

Trece de los tumores radicaban en el lado derecho y 4 en el izquierdo; 7 quedaban cerca de cisuras o eran subpleurales. En 15 de los casos, los tumores contenían cartílago y algunos de los otros tejidos caracterizados: epitelio, músculo liso, tejido adiposo, hueso, linfocitos y tejido conjuntivo. En 2 casos, el diagnóstico resultó difícil, aun con el examen histológico.

Entre los 17 enfermos, la proporción de hombres a mujeres fué casi de 2 a 1; la edad media fué aproximadamente cuarenta y siete años, y la individual varió de veintiún a sesenta y dos años. Los síntomas no fueron de ayuda en el diagnóstico; además, sólo en 5 casos hubiera podido basarse en los hallazgos roentgenográficos un diagnóstico posible o probable de hamarcioma. No parece probable que la broncoscopia hubiera poseído valor diagnóstico, ni que el examen citológico del esputo hubiera excluído la posibilidad de carcinoma. El estudio de los 17 casos no reveló ninguna alternativa de la toracotomía exploradora en el diagnóstico.

Las observaciones realizadas en los 17 casos convinieron en general con las de otros, excepción hecha de que, en estos casos, los hallazgos roentgenográficos fueron menos típicos que lo que han juzgado algunos otros investigadores.

Surgical Experience with Asymptomatic Intrathoracic Growths[1]

SAMUEL O. FREEDLANDER M.D., SIDNEY WOLPAW, M.D., and HARVEY J. MENDELSOHN, M.D.
Cleveland Heights, Ohio

MOST PATIENTS and many doctors are still shocked by the discovery of widespread and often progressive disease without symptoms. If the nature of the lesion is such that operation is advised, the surprise often turns into panic. The classification and description of disease have been so long based upon symptom complexes that a full recognition of the limitations of signs and symptoms will require a long period of education.

Mass x-ray chest surveys, which are intended chiefly to detect tuberculosis, have gathered in the meshes of the diagnostic screens a varied and startling assortment of other intrathoracic diseases. After applying all the known diagnostic criteria, a residue is left in which an absolute diagnosis cannot be made. If the disease is localized, these patients are often sent to a thoracic surgeon for exploratory thoracotomy.

The patient or his family usually ask four questions. Is it a cancer? Can it become a cancer? Will it grow larger? How dangerous is the operation? Only the last one can be answered with the statement that exploratory thoracotomy, as such, carries a very slight risk.

The source of the material presented in this paper is mass chest x-ray survey, school survey, industrial survey, and chest films taken in the course of a routine individual diagnostic survey. All of the patients were either completely asymptomatic or had slight symptoms which could be elicited only after close questioning.

The diagnostic methods are listed. In most of the cases reported here, as many of these procedures were used as were thought necessary or practical before submitting the patient to operation.

1. *Clinical History*
   - Occupational data
   - Geographic data
   - Tuberculosis contact
2. *Physical Examination*
   - Extrapulmonary lesions
3. *Roentgen Examination*
   - Fluoroscopy
   - Laminagraphy
   - Bronchography
   - Angiography
   - Serial observations
   - System review
4. *Skin Testing*
   - Tuberculin
   - Histoplasmin
   - Coccidioidin
5. *Bronchoscopic Examination*
   - Bronchial aspiration
6. *Laboratory Examinations*
   - Sputum: B. tuberculosis, fungi
   - Gastric aspiration: B. tuberculosis culture
   - Blood counts
   - Blood chemistry
   - Serology
   - Agglutinations
7. *Pathologic Examinations*
   - Bronchial and sputum cytology
   - Biopsy material
   - Aspiration biopsy
8. *Diagnostic Pneumothorax and Thoracoscopy*
9. *Exploratory Thoracotomy*

MEDIASTINAL LESIONS

CASE 1 (Fig. 1): On mass x-ray survey, a large tumor was discovered in the left lower thorax of a 47-year-old white female who had absolutely no symptoms. Seventeen years previously she had a left radical mastectomy for carcinoma.

Physical examination revealed dullness and absence of breath sounds in the lower half of the left chest, posteriorly. The films showed a large, well demarcated tumor occupying the posterior lower half of the left chest. The heart and trachea were pushed to the right.

At operation, a large, well encapsulated mass was removed from the posterior mediastinum. It proved to be a benign ganglioneuroma.

CASE 2. (Fig. 2): During a routine school survey, an encapsulated mass was found in the upper poste-

[1] From the Departments of Surgery and Medicine, Mt. Sinai Hospital, and Western Reserve University School of Medicine, Cleveland, Ohio. Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

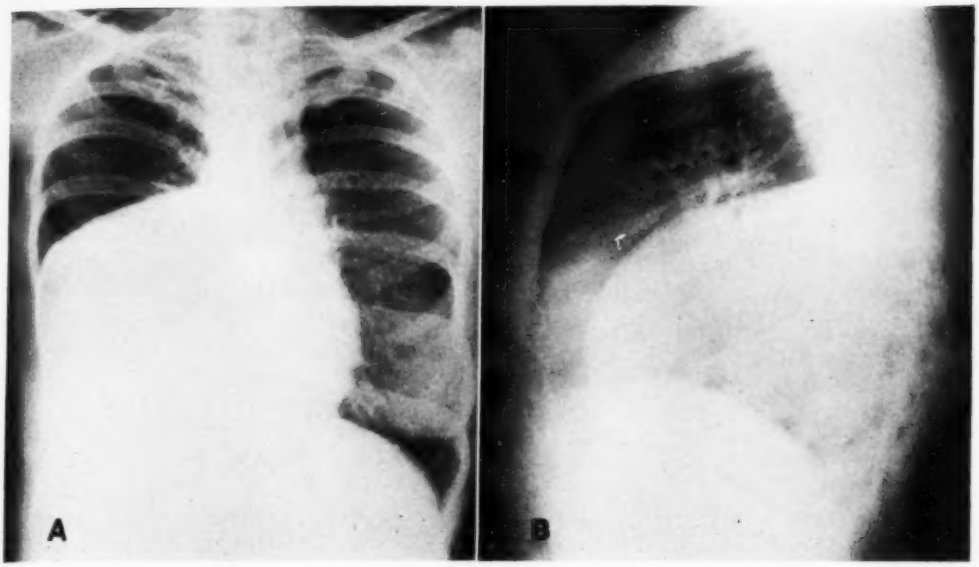


Fig. 1. Case 1. A. Postero-anterior view (reversed right to left) showing large posterior mediastinal ganglioneuroma on left. B. Left lateral view.

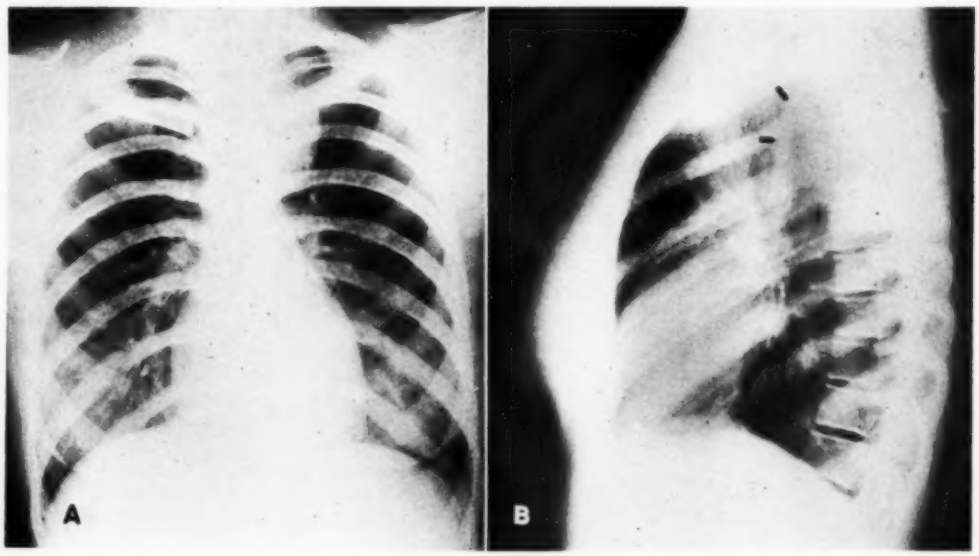


Fig. 2. Case 2. Postero-anterior and left lateral views showing left posterior mediastinal ganglioneuroma.

rior left chest. Since there were no symptoms, no immediate treatment was advised. In a resurvey, two years later, the shadow appeared to be slightly larger. There were still no symptoms, and physical examination was negative. The posterior location of this mass, together with slight calcification suggested that it was a neurogenic tumor. On fluoroscopy, it showed no pulsation and it did not move with swallowing.

A well encapsulated posterior mediastinal mass was removed and proved to be a ganglioneuroma.

Comment: Cases 1 and 2 illustrate a rather common tumor of the posterior

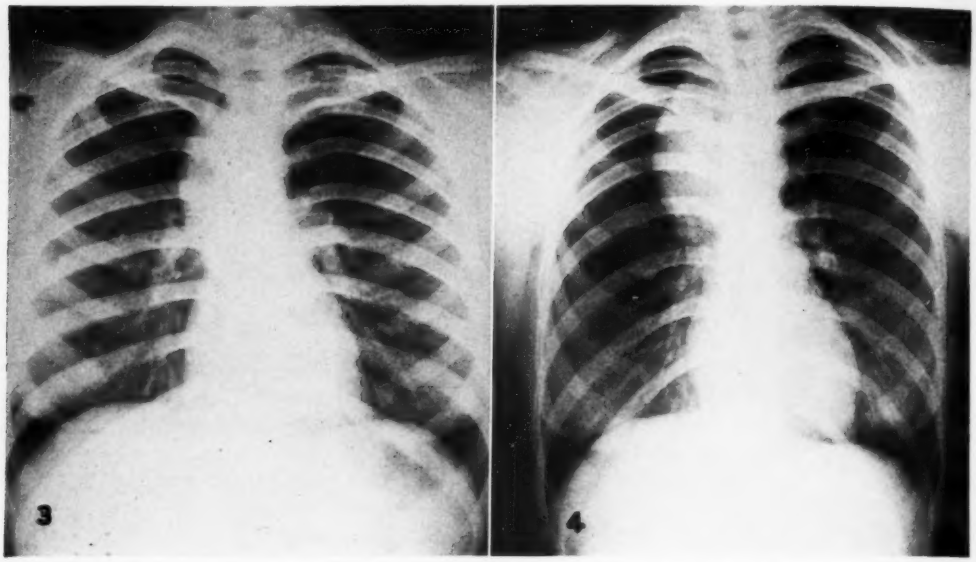


Fig. 3. Case 3. Postero-anterior view showing right upper posterior mediastinal ganglioneuroma with areas of sympathicoblastoma.
Fig. 4. Case 4. Postero-anterior view showing right upper mid-mediastinal paratracheal cyst.

mediastinum. Neither had histologic characteristics of malignancy. However, it is impossible to know this without removal, as the following case will illustrate.

CASE 3 (Fig. 3): An upper posterior mediastinal shadow was found in a 16-year-old white female during a high-school survey. There were no symptoms or physical signs. Since the discovery was made during the middle of the school year, it was thought safe to wait until vacation before advising operation. However, a film taken two months later showed a definite increase in the size of the shadow.

At operation, a well encapsulated posterior mediastinal mass was removed. Histologically, in addition to the well differentiated ganglion cells, there were many areas of small cells suggesting a sympathicoblastoma, classified histologically as malignant. So far, there has been no recurrence.

CASE 4 (Fig. 4): During a routine industrial survey, an upper mid-mediastinal shadow was found in the right chest. The only symptom, discovered on close questioning, was vague chest pain. Serial films were taken over a period of three years and there was no change in size of the shadow. The patient had become apprehensive, however, knowing that she had a tumor, and wanted it removed. On fluoroscopy, the shadow was found to move with swallowing and to show transmitted pulsation. It was therefore thought to be connected with the trachea.

At operation a well encapsulated tracheal cyst, 8 × 4 cm., was removed. A wide defect in the cartilage of the trachea at the site of attachment of the cyst was repaired, and recovery was uneventful.

Microscopically, the wall of the cyst was lined with ciliated columnar epithelium.

CASE 5 (Fig. 5): While being examined for the Navy in 1943, a 27-year-old white male was found to have an upper mid-mediastinal tumor. He was completely asymptomatic until February 1945, when he began to have some vague chest pain and films showed that the shadow had become much larger.

In February 1945, a large paratracheal cyst was removed. Histologically it showed respiratory epithelium and cartilage in the wall.

The patient has remained well since.

CASE 6 (Fig. 6): A posterior mediastinal mass was found during an industrial survey in a 40-year-old white female. She had no definite symptoms. The shadow was well demarcated. There were some erosion and enlargement of the vertebral foramina.

Examination revealed multiple neurofibroma and it was suggested that the shadow represented a neurofibroma with extension into the spinal canal. At operation, however, a meningocele was found, extending into the spinal canal. It was partially removed and the defect covered. The patient has remained well to date.

CASE 7 (Fig. 7): A colored female, age 38, was admitted to City Hospital because of severe rheumatoid arthritis. There were no complaints referable to the chest.

Routine physical examination revealed dullness and decreased breath sounds at the right base.

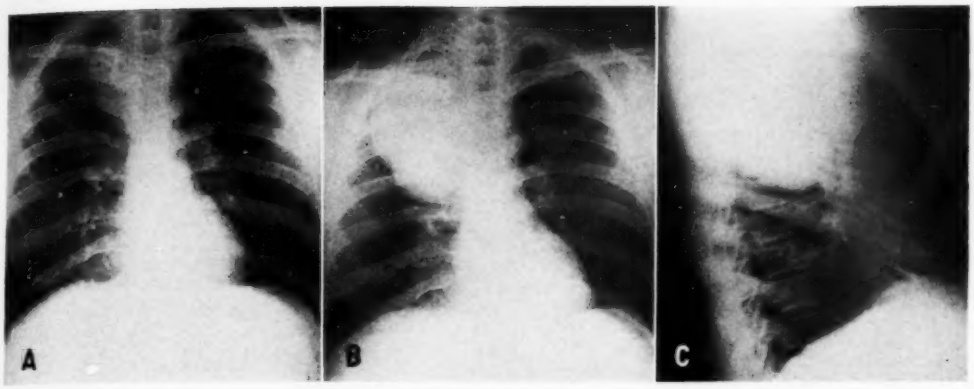


Fig. 5. Case 5. A. Postero-anterior view showing right upper paratracheal cyst, Jan. 19, 1944. B and C. Postero-anterior and lateral views showing marked enlargement, Feb. 25, 1945.

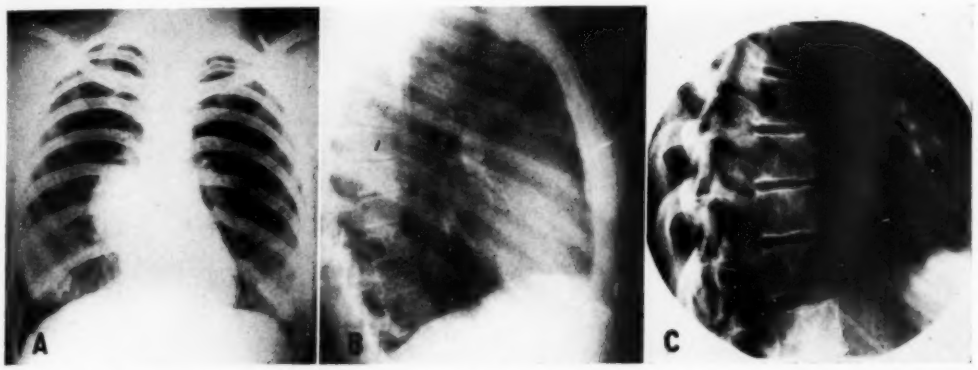


Fig. 6. Case 6. A. Postero-anterior view showing right-sided lesion. B and C. Lateral films showing posterior location of lesion and defects in vertebrae. Proved to be a meningocele.

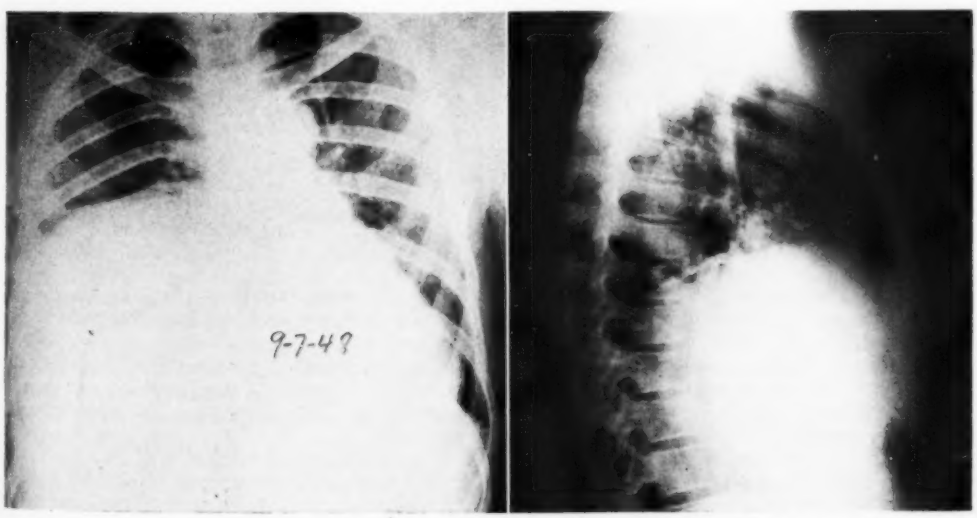


Fig. 7. Case 7. Postero-anterior and right lateral views of leiomyofibroma above right diaphragm.

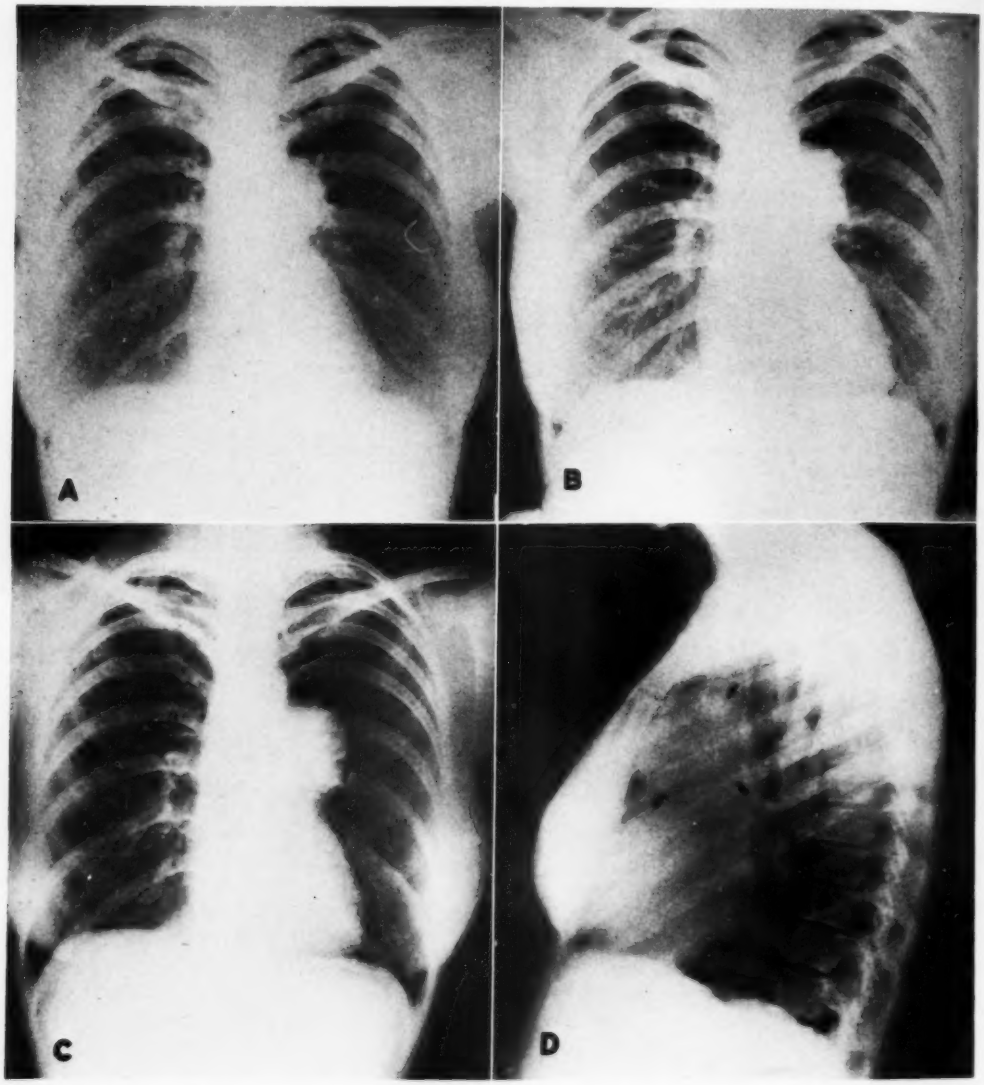


Fig. 8. Case 8. A–C. Postero-anterior films showing left anterior mediastinal lesion enlarging over a five-month period. D. Left lateral film showing anterior location of teratoma.

Films of the thorax showed a large shadow in the lower right chest. Fluoroscopic examination revealed no pulsation. Aspiration produced only blood. Gastro-intestinal studies and pyelograms showed no relation of the abdominal structures to the mass. Diagnostic pneumothorax was attempted but was unsuccessful because of adhesions. Diagnostic pneumoperitoneum showed the lesion to be above the diaphragm.

Exploratory thoracotomy revealed a large firm tumor, well encapsulated, attached by a broad pedicle to the upper surface of the right diaphragm. The histologic diagnosis was leiomyofibroma of the diaphragm.

The patient made an uneventful recovery and the joint pains disappeared. Review of the films showed hypertrophic pulmonary osteoarthropathy in the extremities.

CASE 8 (Fig. 8): A routine chest film was taken during examination of a 25-year-old white female, in the fifth month of pregnancy. A shadow was found in the anterior mediastinum. Since it was thought

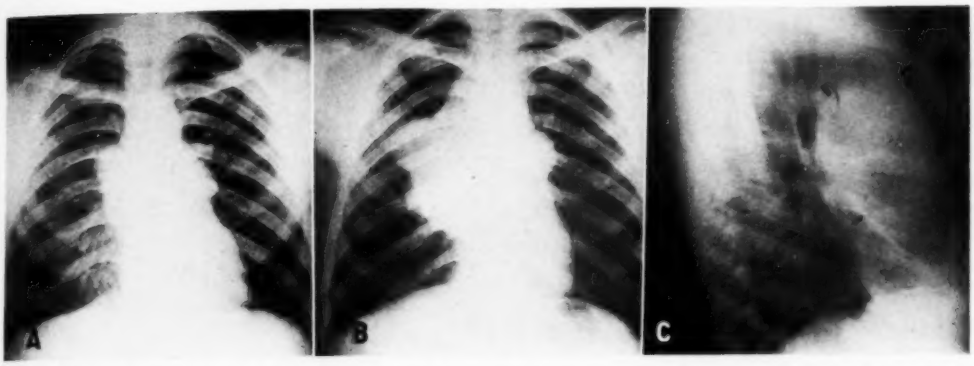


Fig. 9. Case 9. A and B. Postero-anterior films showing enlargement of anterior mediastinal choriocarcinoma over a four-month period. C. Lateral film made prior to operation.

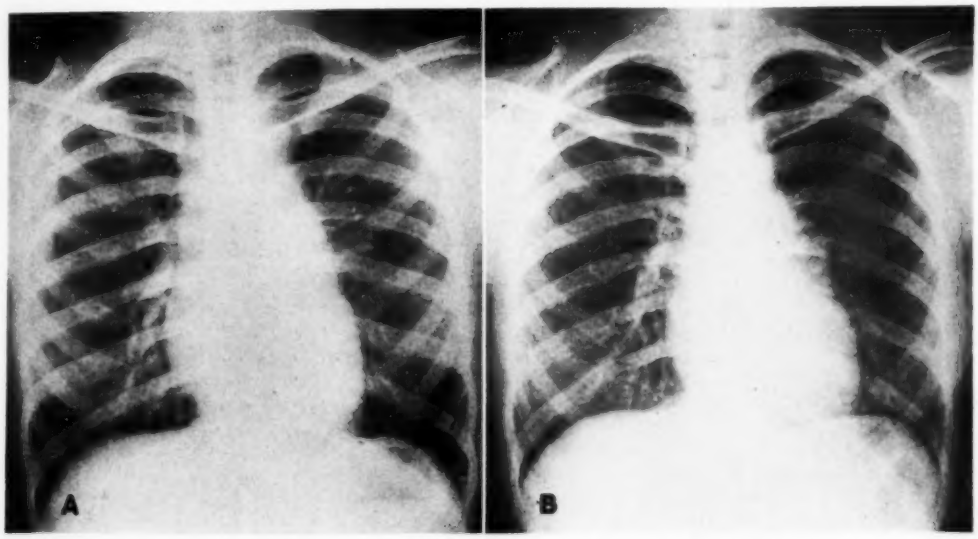


Fig. 10. Case 10. A. Malignant thymoma before x-ray therapy. B. After treatment with 3,000 r of high-voltage x-rays.

that this probably represented a dermoid cyst, and since the patient was extremely anxious to have a viable child, it was decided to wait until termination of the pregnancy before operating. However, the shadow grew progressively larger and eight x-ray treatments were given during the eighth month of pregnancy. These did not affect the size of the shadow. In July 1949, the patient was delivered of a healthy child, and in August an exploratory thoracotomy was done. A well encapsulated mass, which proved to be a dermoid cyst, was removed from the anterior mediastinum.

It is a well-known fact that certain benign tumors grow during pregnancy. However, the danger of watchful waiting is illustrated by the next case.

CASE 9 (Fig. 9): In August 1948, a 26-year-old white male had a chest film taken during an industrial survey. A mass was demonstrable in the anterior mediastinum. X-ray treatments were advised, and after receiving six treatments, the patient returned to his home town in a different part of the country. During the treatments and afterward, pain developed in the right chest and there was said to be some difficulty in respiration. There was no weight loss but the patient was very apprehensive because he was told that the tumor had grown.

Films demonstrated a marked increase in the size

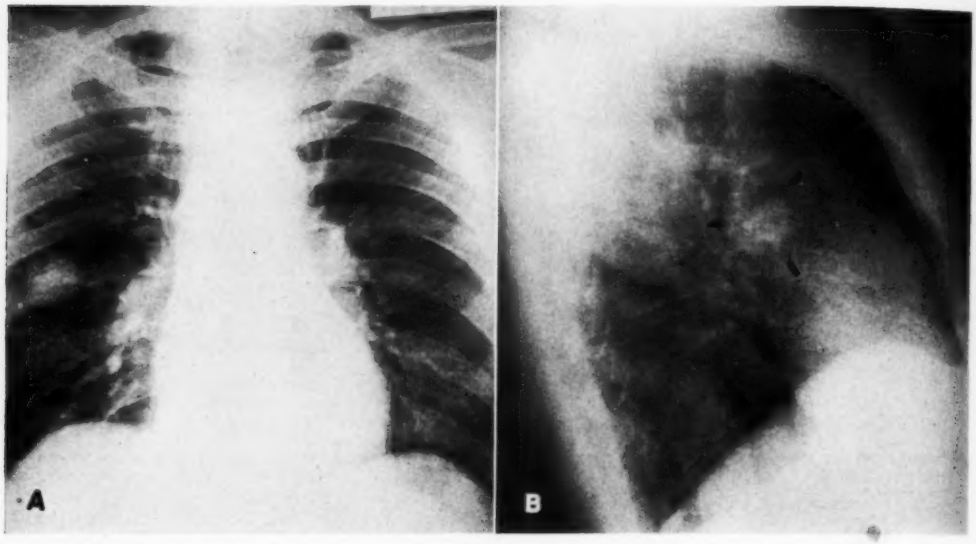


Fig. 11. Case 11. A. Solitary peripheral adenocarcinoma of bronchus. B. Lateral view.

of the shadow, and nine more x-ray treatments were given without effect. On physical examination there was dullness to percussion anteriorly on both sides of the sternum. Preoperative films showed a large anterior mediastinal mass protruding on both sides of the mediastinum, with lobulated margins.

At thoracotomy, a large partially encapsulated tumor mass was found filling the anterior mediastinum, adherent to the pericardium and with upward extension and invasion. This mass was removed as completely as possible. The histologic diagnosis was choriocarcinoma.

In a few months there was rapid recurrence of the growth and death ensued several months after the operation.

It may be merely a coincidence that increase in the size of the growth accompanied the x-ray treatments.

CASE 10 (Fig. 10): While being examined in the Student Health Service, a 26-year-old white female was found to have an enlargement of the upper anterior mediastinum. She was completely asymptomatic. For some unknown reason, no advice regarding treatment was given until one and a half years later, when a tumor was found protruding through the anterior chest wall. Biopsy proved this to be a malignant thymoma.

X-ray therapy caused a rapid regression of the growth, and for a period of one year the patient remained asymptomatic. Recently enlargement of the supraclavicular lymph nodes has developed.

PULMONARY GROWTHS

CASE 11 (Fig. 11): While walking along the street in September 1948, a 48-year-old white male, an attorney, passed an x-ray chest survey trailer. He joined the line for examination, and a small nodule was found in the right lower lung field. The patient was completely asymptomatic.

The physical examination was negative. A gastro-intestinal series and pyelograms were negative except for a rectal polyp, which on removal proved to be benign.

Tuberculin skin tests were positive; histoplasmin and coccidioidin tests were negative. The sputum tests were negative for tubercle bacilli.

Exploratory thoracotomy confirmed the presence of a firm nodule in the right lower lobe. A frozen section showed this to be a carcinoma, and a total pneumonectomy was done. Histologically, the tumor was an adenocarcinoma, bronchiogenic in origin, with metastases to the bronchopulmonary and paratracheal nodes.

Although the patient made an uneventful postoperative recovery, he died of cerebral metastases nine months later.

CASE 12 (Fig. 12): In December 1947, during a mass x-ray chest survey, a 59-year-old white male was found to have a small tumor in the lower part of the left lung field. He was re-examined two months later and there seemed to be a slight increase in the size of the lesion. There were no symptoms.

Bronchoscopy and sputum tests were negative.

Exploratory thoracotomy was done in February 1948, revealing a large infiltrating mass in the left lower lobe, with some enlargement of mediastinal lymph nodes. Grossly this was thought to be a carcinoma, and a left pneumonectomy was done. Histologically, however, it proved to be a tuberculoma. Thus far, the patient has remained well.

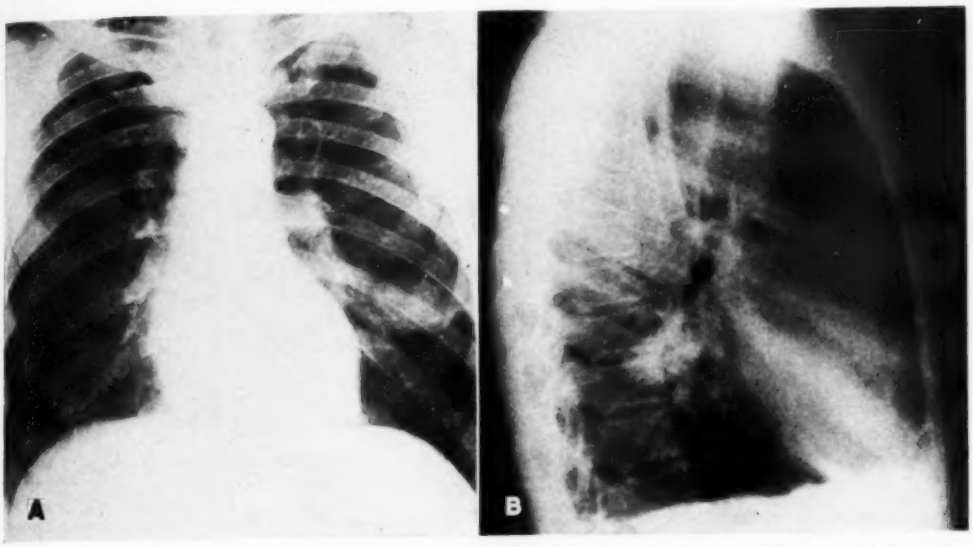


Fig. 12. Case 12. A. Postero-anterior film showing solitary lesion, relatively peripheral, in left lower lobe. Proved to be a tuberculoma. B. Left lateral film.

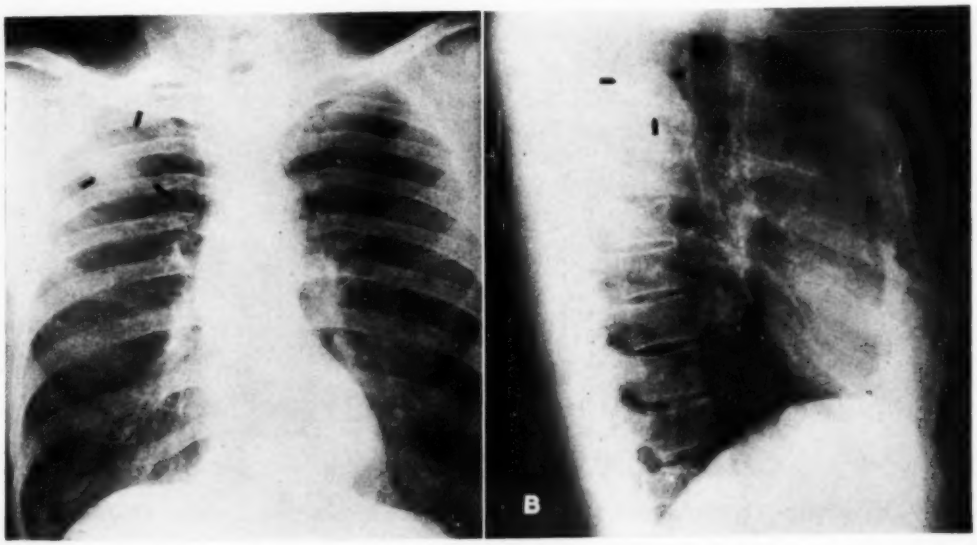


Fig. 13. Case 13. A. Postero-anterior film showing peripheral squamous-cell carcinoma in right upper lobe. B. Right lateral film.

CASE 13 (Fig. 13): Six weeks prior to operation, a 57-year-old white male had a chest film taken at the County Clinic, though he was asymptomatic. A small infiltration was found in the right upper lung field. Hemoptysis occurred a few weeks later.

Bronchoscopic examination was negative. The tuberculin test was positive. Sputum tests were negative for tubercle bacilli.

At operation, a squamous-cell carcinoma of the right upper lobe was found, with metastases in the regional lymph nodes. A right upper lobectomy was performed, and the patient has done well.

CASE 14 (Fig. 14): During the course of a routine physical examination and fluoroscopy in 1939, a 42-year-old white female was told that she had a small nodule in the right upper lung field. This was con-

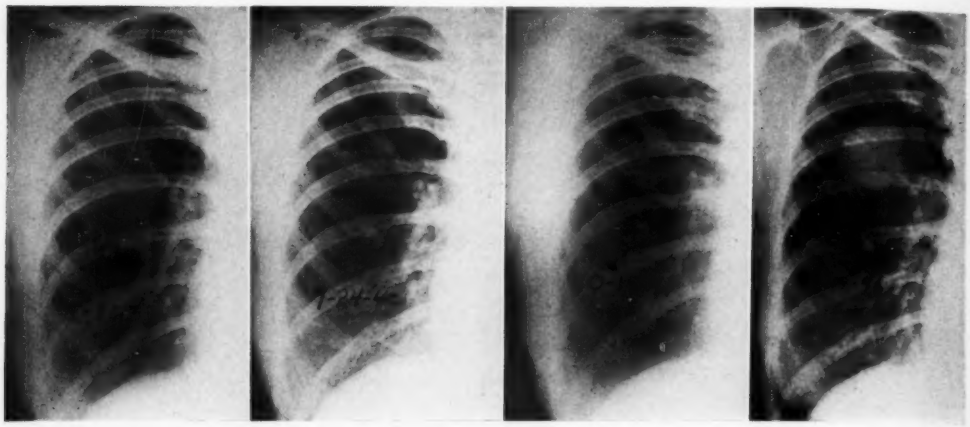


Fig. 14. Case 14. Postero-anterior films showing enlargement of a right upper lobe adenoma of the bronchus over a seven-year period, Aug. 22, 1939 to Dec. 14, 1946.

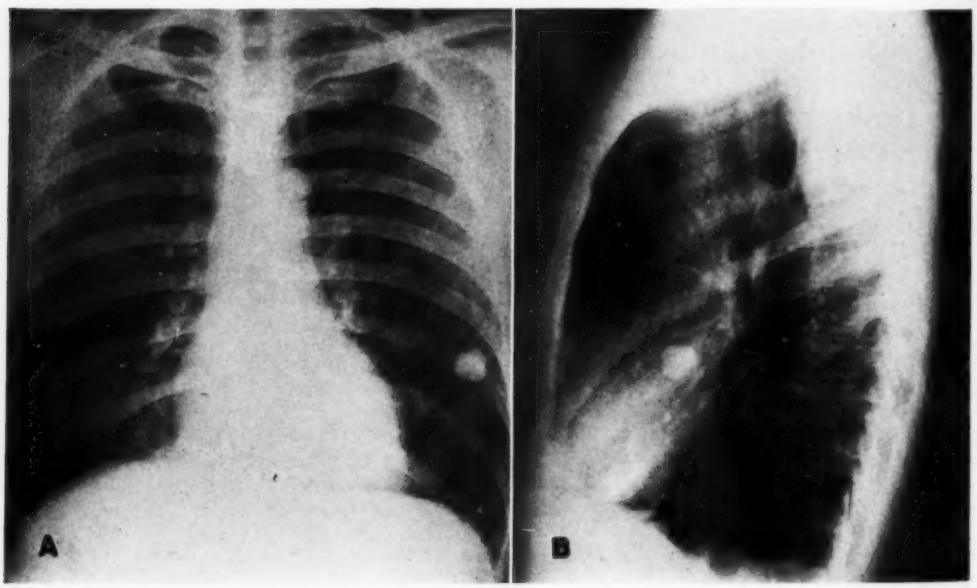


Fig. 15. Case 15. A. Postero-anterior film showing a peripheral tuberculoma. B. Left lateral film.

firmed by films. During the next few years, serial x-ray studies were done, but because of the absence of symptoms, no treatment was advised, in spite of a slight increase in the size of the shadow. In 1946, for the first time, hemoptysis occurred, and at this time the shadow was definitely larger. Sputum examinations were negative for tubercle bacilli, and bronchoscopy was negative.

An exploratory thoracotomy was done in December 1946, showing a partial atelectasis and a tumor in the right upper lobe. There was no enlargement of the regional lymph nodes.

The tumor was removed. Histologically, it was a bronchial adenoma, benign. The patient has remained well since.

CASE 15 (Fig. 15): During a routine industrial survey, a well defined nodule of the left lower lobe was found in a 50-year-old white male. There were no symptoms, and physical examination was entirely negative. Skin tests showed positive tuberculin, positive histoplasmin, and negative coccidioidin reactions. Gastro-intestinal studies and pyelograms were normal. The sputum and gastric contents were negative for tubercle bacilli and fungi. Lamin-

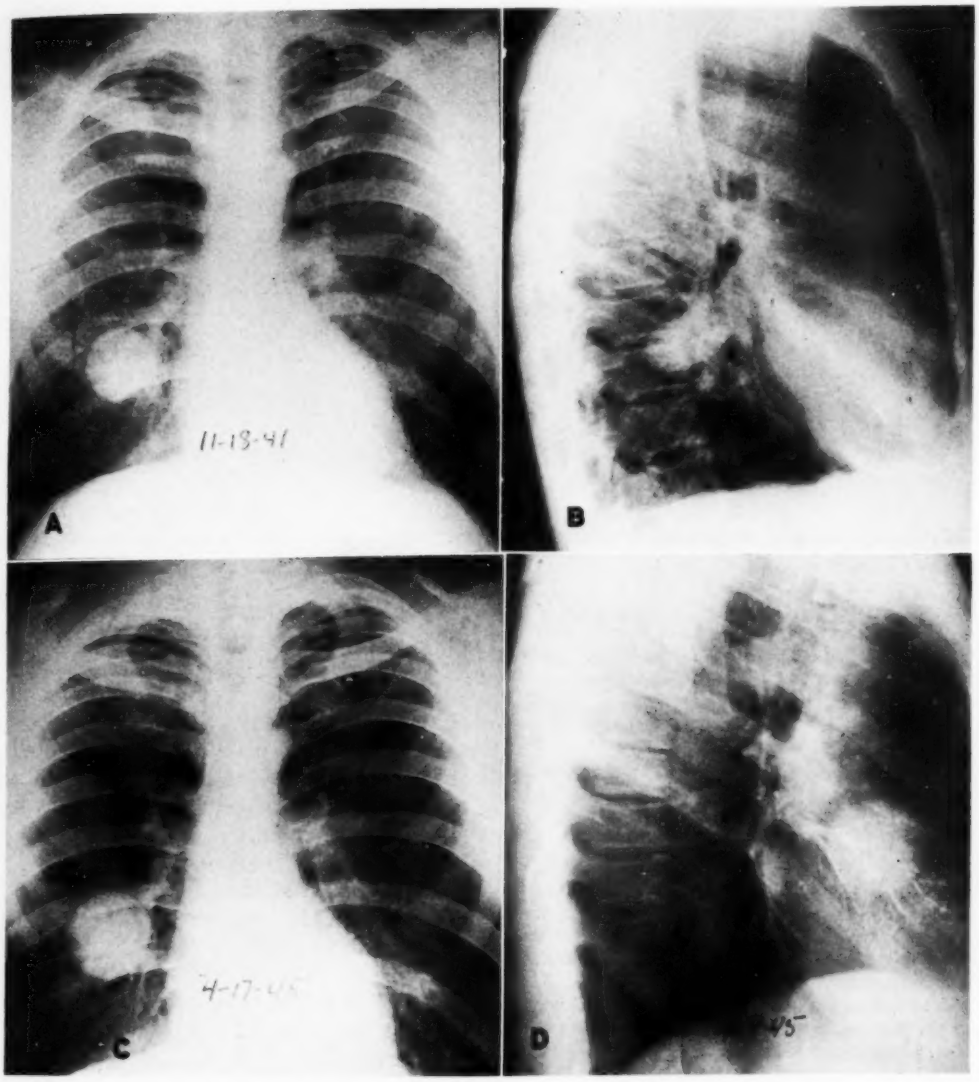


Fig. 16. Case 16. Fibroma of right middle lobe. A. and B. Films obtained in 1941. C. and D. Films obtained in 1945.

agrams showed no calcific center in the nodule.

At operation, a firm nodule about 2 cm. in diameter was found in the lower lobe of the left lung. A wedge resection was done and frozen section showed the nodule to be a tuberculoma. Under streptomycin therapy recovery was uneventful.

CASE 16 (Fig. 16): During a routine industrial survey in 1941, a 45-year-old male was found to have a well defined nodule in the lower right lung field. Since there were no symptoms or physical signs, observation was advised. In 1945, the mass was found to have increased in size, although there were still no symptoms. The serology was negative. Gastro-intestinal studies and pyelograms were normal. Bronchoscopic examination was negative. Bronchography revealed no evidence of obstruction. Sputum and material aspirated at bronchoscopy showed no specific cells or organisms.

Exploratory thoracotomy revealed a well encapsulated mass about 2 cm. in diameter, which was easily shelled out of the right middle lobe. The histologic diagnosis was fibroma.

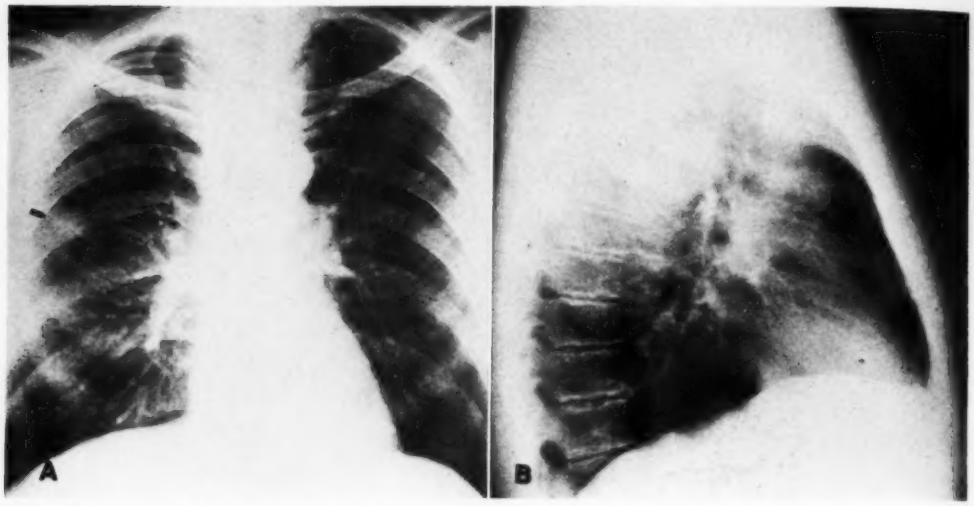


Fig. 17. Case 17. A. Postero-anterior film of peripheral squamous-cell carcinoma of bronchus. B. Right lateral film.

CASE 17 (Fig. 17): During the Greater Cleveland chest x-ray survey, a shadow was found in the right mid lung field of a 69-year-old white male. He was essentially asymptomatic, the sputum was negative for tubercle bacilli, and the bronchoscopic examination was normal. Previous films taken in 1945 were located and found to be negative.

In October 1949, a right pneumonectomy was done, and the lesion proved to be a poorly differentiated squamous-cell carcinoma of the bronchus.

CASE 18 (Fig. 18): During a chest survey, a mass was found in the left lower lung field of a 56-year-old female. She was completely asymptomatic. Previous films, taken in 1945, showed a tumor in the same location but definitely smaller. Bronchoscopy and sputum examinations were not helpful in establishing the diagnosis.

An exploratory thoracotomy was advised because of the change in the size of the tumor. At operation, a well encapsulated firm mass was found in the anterior portion of the interlobar fissure. The lung was slightly adherent and could be peeled away. There was no evidence of gross enlargement of the regional lymph nodes or invasion of the lung tissue.

The pathologists disagreed concerning the histologic diagnosis of the tumor. One of them called it a mesothelioma of the pleura with invasion of the bronchus and lung tissue. Another called it an oat-cell carcinoma of the lung. The fact that it was well encapsulated and not in pulmonary tissue, and yet contained adult bronchial remnants, would be consistent with the diagnosis of hamartoma.

DISCUSSION

The group of cases reported represents only a part of a larger series of asymptomatic localized intrathoracic lesions which were explored. A statistical survey is not possible at this time because of the incompleteness of the analysis. In previous mass surveys, 0.5 to 0.8 per cent of the small films showed some pathological lesion other than tuberculosis. The localized pulmonary lesions are the more serious because of the hazard of bronchiogenic carcinoma. In the cities of Minneapolis, Seattle, and Washington, it was estimated that 10 primary carcinomas of the lung would be found per 100,000 population. Of 21 cases of so-called coin lesions of the lung explored by Drs. E. J. O'Brien, Wm. M. Tuttle and Joseph E. Ferkaney (1) 38 per cent proved to be bronchiogenic carcinoma and 38 per cent tuberculoma. Watson (2), at Memorial Hospital (New York) reported that of 104 silent tumors which were explored, 41 were malignant and 63 benign. Overholt and Schmidt (3) recently reported that of 65 asymptomatic localized lesions for which operation was done, 19 were malignant, 35 were benign, and 10 were of undetermined histology.

The mediastinal shadows will include a much larger number of benign lesions. However, even in these, as has been illus-

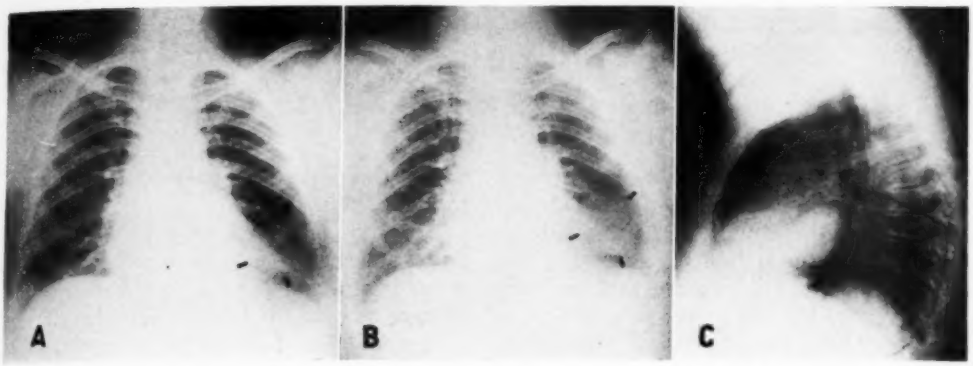


Fig. 18. Case 18. A. Postero-anterior film, 1945. B. and C. Postero-anterior and left lateral films showing enlargement of interlobar hamartoma prior to resection in 1949.

trated, the prognosis may be unpredictable. Except for mid-mediastinal lesions where lymphoma may be suspected, roentgen treatment of localized intrathoracic masses may lead to dangerous delay of operation.

While mass surveys have shown significant results in picking up early carcinoma, a survey of the male population over the age of forty-five, at intervals of six months, would probably increase the yield considerably.

CONCLUSIONS

A series of localized asymptomatic intrathoracic lesions has been presented, with operative findings.

Extensive and progressive malignant disease may be present without symptoms.

Watchful waiting or ill-advised x-ray therapy may be hazardous.

Exploratory thoracotomy is a relatively harmless procedure and in many cases may be the only method for the diagnosis and eradication of malignant disease in its earlier stages.

2460 Fairmount Blvd.,
Cleveland Heights 6, Ohio.

REFERENCES

1. O'BRIEN, E. J., TUTTLE, W. M., AND FERKANEY, J. E.: Management of Pulmonary "Coin" Lesion. Surg. Clin. North America **28:** 1313–1322, October 1948.
2. WATSON, W. L.: Personal communication to the authors.
3. OVERHOLT, RICHARD H., AND SCHMIDT, IVAN C.: Silent Phase of Cancer of the Lung. J. A. M. A. 141: 817–820, Nov. 19, 1949.

SUMARIO

Observaciones Quirúrgicas en los Tumores Intratorácicos Asintomáticos

Esta serie de lesiones intratorácicas asintomáticas localizadas, descubiertas en encuestas torácicas corrientes, es presentada con los hallazgos operatorios, comprendiendo: ganglioneuromas mediastínicos, quiste paratraqueal, meningocele, leyomiofibroma, teratoma, coriocarcinoma mediastínico, timoma maligno, adenoma y adenocarcinoma bronquiales, tuberculoma, carcinoma escamocelular, fibroma y hamarcioma.

El estudio de este grupo de casos revela que puede haber afección maligna extensa y progresiva en el tórax sin síntomas. La expectativa vigilante y la roentgenoterapia poco juiciosa pueden resultar peligrosas. La toracotomía exploradora es un procedimiento relativamente inocuo y en muchos casos tal vez sea el único método de diagnóstico y de completa erradicación de una afección maligna en sus etapas tempranas.

The Pathologist's Approach to Pulmonary Neoplasms[1]

ALAN R. MORITZ, M.D.[2]
Cleveland, Ohio

FORMERLY, THE most that was accomplished by making a positive diagnosis of cancer of the lung was (1) to establish the fact that the patient was going to die quite soon and (2) to prevent him from being treated for any one of several potentially curable diseases that pulmonary cancer may simulate. Today the situation is quite different. Cancer of the lung is a curable disease if recognized in time. This has led to new interest in its pathological anatomy and histology.

Carcinoma of the lung certainly appears to occur with greater frequency now than it did fifty years ago. How much of this apparent increase is real is unproved. It is a fact that many people who now live long enough to acquire cancer would formerly have died prematurely of infection. It is also true that many pulmonary cancers that would be recognized as such today were misdiagnosed a few decades ago. At the turn of the century many of the pulmonary cancers seen in the autopsy room were erroneously diagnosed as mediastinal sarcoma, pleural or pericardial endothelioma, or lymphatic tumor, by pathologists who were unaware of the structural versatility of bronchogenic carcinoma.

None of these factors would seem adequate, however, to explain the disproportionate increase of pulmonary cancer in comparison to the increase of cancer in other organs. Thus, Lund found at the Pennsylvania Hospital that during the last fifty years pulmonary cancer had moved from twenty-third to third place among malignant tumors in men. Such a shift as this can hardly be accounted for by the general increase in morbidity from cancer, nor is it likely due entirely to previous failure on the part of the pathologist to recognize the disease.

The preponderance of evidence is that carcinoma of the lung is increasing in frequency and that the increase is disproportionate to that of tumors elsewhere.

Age and Sex Incidence: Jonassen, in a recent unpublished review of 100 cases of verified pulmonary cancer seen at the University Hospitals in Cleveland during the last decade, found the disease more prevalent in men than in women, in a ratio of 8:1. This is in general agreement with the observations of other reviewers. It will be interesting to see during the next ten years whether the now common practice of cigarette smoking by women leads to a reduction of the difference in sex incidence.

In approximately two-thirds of this series the tumor was recognized during the fifth or sixth decade of life.

It was found that the incidence in colored patients was definitely lower than in white. At the University Hospitals, colored patients constitute 20 to 30 per cent of the hospital population, whereas only 6 of the 100 patients with pulmonary cancer were Negroes.

Tumor Type: We believe that primary carcinoma of the lung falls into six categories, as follows:

Squamous-cell carcinoma	37%
Adenocarcinoma	18%
Anaplastic	
Small-cell carcinoma	23%
Carcinoma simplex	18%
Bronchial adenoma	3%
Alveolar carcinoma	1%

Squamous-cell Carcinoma: The mean age of patients with squamous-cell carci-

[1] Presented at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio Dec. 4–9, 1949.

[2] Professor of Pathology and Director of the Institute of Pathology, Western Reserve University, Cleveland, Ohio.

noma of the lung in our series is fifty-eight years. The tumor usually arises in a primary bronchus and is characteristically first manifested by symptoms and signs of bronchial obstruction. Because of the frequently associated atelectasis and pneumonia, the lesion is rarely sharply defined on the roentgenogram. In patients who are seen early enough for recognition of the site of origin, approximately two-thirds of the tumors are central and one-third peripheral. These tumors often attain massive proportions, with central ulceration and cavitation, before metastasizing. Metastasis to the brain occurs with relative frequency; it is less frequent to the cervical lymph nodes, adrenals, liver, and spleen.

Adenocarcinoma: The age incidence of pulmonary adenocarcinoma is in general similar to that of squamous-cell carcinoma, though some have found it to occur at an earlier age, midway between squamous- and small-cell carcinoma. The tumor usually arises in secondary or tertiary bronchi, and in about 50 per cent of the cases is peripheral in location. It is frequently manifest as a discrete rounded mass. The rate of growth is variable, and bronchial obstruction is characteristically of late occurrence. Like small-cell carcinoma, adenocarcinoma metastasizes to the tracheobronchial and cervical lymph nodes, the liver, adrenals, and spleen.

Small-cell Carcinoma: The mean age of patients with small-cell carcinoma is approximately ten years below that for squamous-cell carcinoma, probably because of the more rapid growth of the former tumor and the earlier appearance of symptoms. The origin is characteristically in a main stem bronchus, and the primary lesion may remain small and inconspicuous, without producing obstruction, while the tracheobronchial and mediastinal lymph nodes show early and massive involvement. Thus an expanding hilar mass without emphysema or atelectasis suggests a small-cell carcinoma, whereas a tumor recognized first because of bronchial obstruction (emphysema or atelectasis) is more likely to be a squamous-cell carcinoma.

Carcinoma Simplex: Carcinoma simplex may mimic squamous-cell carcinoma or adenocarcinoma in age incidence, location, roentgenologic appearance, growth characteristics, and metastases. In contrast to the small-cell carcinoma, carcinoma simplex is composed of large spherical or pleomorphic cells and is often seen in combination with adenocarcinoma or squamous-cell carcinoma. It is not uncommon to find a tumor reasonably well differentiated and squamous at its primary site and undifferentiated in its metastases.

Bronchial Adenoma: Bronchial adenoma is in general a tumor of young persons, having been seen as early as eleven years. It has also been known to occur as late as seventy-nine years. It usually develops in a large bronchus, particularly the right lower, and leads to early obstruction. Growth may be principally intrabronchial, or the lesion may be of the collar-button form, with more tumor outside than inside the lumen. Local invasion is the rule.

Alveolar-cell Carcinoma: The outstanding characteristic of alveolar-cell carcinoma is its utilization of the alveolar septa for support and nutrition. In its simplest form the tumor is invasive only in the sense that its cylindrical cells invade the alveolar spaces and line them without apparent destruction of existing pulmonary tissue. This process may be circumscribed, may take place in multiple discrete centers, may spread diffusely simulating pneumonia, and may be unilateral or bilateral.

Tumors of this type are characteristically accompanied by pneumonia. Ulceration with cavitation is not uncommon and is due either to local destruction and malignant change on the part of the tumor or to the inflammatory process which accompanies it. So long as the tumor is non-destructive and non-metastasizing, the term pulmonary adenomatosis is appropriate. When such a tumor undergoes malignant change, manifested by invasive destruction of pulmonary parenchyma or by metastasis, the term alveolar-cell carcinoma would seem to be as appropriate as any other.

Diagnosis: In Jonassen's series of 100 proved cases, the lesions were recognized radiologically as possible or probable pulmonary cancer in 70. A diagnosis of pneumonia was made in 8, simple pleural effusion in 6, metastatic carcinoma in 3, and abscess in 2. Other diagnoses included silicosis, tuberculosis, infarct, cyst, and bronchiectasis.

Bronchial biopsy was performed in 74 of these patients, and in 78 per cent of these, cancer cells were recognized microscopically. In the majority of the remaining 22 per cent, the tumors were peripheral.

Although our experience with the Papanicolaou technic applied to sputum or to bronchial washings is not sufficient to warrant a statistical summary, we are convinced of the value of the procedure. McKay and Ware have reported the recognition of tumor cells in 40 of 54 proved cases of bronchogenic carcinoma. The impression of those working with the method is that when tumor cells are being desquamated they are much more likely to be found in fluid from bronchial washings than in sputum. We believe that cytological study of bronchial washings will probably prove to be more effective than either x-ray examination or the examination of bronchial biopsies in establishing the identity of an early bronchogenic carcinoma.

Two types of tuberculous lesions occasionally simulate primary pulmonary cancer. One is a pulmonary tuberculoma associated with tuberculous peribronchial lymphadenitis; the other is tuberculous bronchial stenosis with accompanying emphysema or atelectasis. Non-tuberculous inflammatory scars of bronchi may also simulate bronchogenic carcinoma, as may an isolated metastasis from a tumor elsewhere in the body, as the breast, stomach, thyroid, or pancreas.

CONCLUSION

The establishment of pneumonectomy as an effective and relatively safe surgical procedure is responsible for widespread interest in the behavior of various types of pulmonary tumor and in the diagnostic methods available for their recognition.

It would appear that radiologic study followed by bronchoscopy, bronchial biopsy, and the examination of smears or bronchial washings represents the sequence that is most effective for the diagnosis of early pulmonary cancer.

Institute of Pathology
Western Reserve University
Cleveland, Ohio

SUMARIO

La Misión del Patólogo en las Neoplasias Pulmonares

Los carcinomas primarios del pulmón corresponden a seis grupos, a saber: carcinoma escamocelular; adenocarcinoma; carcinoma nanocelular; carcinoma simplex; adenoma bronquial; carcinoma alveolar. Las características de cada una de dichas formas aparecen aquí descritas sucintamente. Debido al establecimiento de la neumonectomía como procedimiento quirúrgico eficaz y relativamente inocuo, el diagnóstico temprano de esas lesiones reviste suma importancia. Para ese objeto, el estudio radiológico seguido de la broncoscopia, la biopsia bronquial y el examen de frotes de los lavados bronquiales, representa el sistema más efectivo.

DISCUSSION

(Papers by Lemon and Good; King and Carroll; Paul and Juhl; Freedlander; Moritz)

Aubrey O. Hampton, M.D. (Washington, D. C.): The paper of Drs. Lemon and Good could be accepted as an excellent paper without criticism, or one might question the statistical conclusions. They have said that calcification is of no value in the differential diagnosis of hamartoma; yet in 11 of the 15 cases—that is, of 15 typical cases—calcification was found histologi-

cally. They did not mention that they had made a particular effort to demonstrate this calcification by tomography, multiple spot films, etc. I am convinced that you cannot rule out calcification in a round shadow without tomographic films. I have taken what I considered excellent Bucky and spot films and, to my amazement, found calcium much more clearly shown by tomography.

The hamartomas that I have seen have not shown calcification, perhaps for the same reason that I have mentioned. I was once called to task by the group at the Massachusetts General Hospital at a case presentation because I missed the typical findings of hamartoma, as described by Hickey, namely a fat line surrounding the tumor. This tumor does contain fat but no mention is made by these authors that it was situated around the tumor. We imagined, at first, that the tumor plunged from the mediastinum into the fissures and thereabouts, carrying with it the fat around it. The cases shown today, of course, couldn't plunge quite that far, and perhaps we should rule out another characteristic finding. Certainly a nodular tumor of the lung containing calcification should be classed as a hamartoma until proved otherwise, because of the rarity of calcification in and around pulmonary neoplasms. We must, of course, remember that these tumors may be confused with large, partially calcified tuberculomas.

In the discussions on pulmonary adenomatosis, I have no possibility of criticism or difference of opinion with Drs. King and Carroll. This is what I would call a straightforward presentation of a classical disease in a classical manner.

I would like to differ with Drs. Paul and Juhl, along with a pathologist on our symposium who likes to lump this rare disease into the controversial group called alveolar carcinoma of the lungs. I think that first it should be proved that there is such a thing as an alveolar-cell carcinoma of the lung, which, so far as I know, has not been done. William Snow Miller made no attempt to tell us where these cells in the alveolus of the lung came from. I hope that we can persuade you to list adenomatosis as a benign, but very bizarre, lethal tumor of the lung, because it does not metastasize, does not form pleural fluid, does not enlarge the lymph nodes, and is certainly not very similar clinically to a malignant growth. One patient who was seen in my office for over eighteen months, for x-ray study, did not have copious sputum, which is said to be so classical. Today I learned that it is not copious sputum but copious fluid aspirated by bronchoscopy that is most classical.

We have reason to believe that lobectomy or pneumonectomy does not cure the disease, because we have seen recurrences within six months following such procedure. But, in retrospect, we wonder if the "recurrent" lesion were not already present. In the case shown today there was a lesion on the opposite side at the time of operation. So we have as yet no proof that surgery will not relieve these patients, and I do not believe we should discourage such a procedure. Radiation therapy has certainly not been adequate. A thousand roentgens, I think, were given without effect.

I did not get the idea that adenomatosis was a nodular disease until two lesions of miliary type were shown. I hated to see that because, up until then, I hoped that the picture would be that of lobar pneumonia which failed to resolve in a patient without fever, and probably with copious sputum. We tried bronchial washings without conclusive evidence as to the type of tumor, but tumor cells were found.

Dr. Freedlander's paper dealing with survey chest examinations and the tumors found therein follows along pretty closely with our experience in Washington. I would like to add a verbal communication from another thoracic surgeon, Dr. Edgar W. Davis of Washington, who has reviewed 91 round tumors of the parenchyma of the lung which contained no calcium, showed no cavity, and were not in contact with the pleura. Of these 91 cases, 55 per cent were malignant—these are sharp, round shadows and 55 per cent were malignant. Twenty-eight per cent of the malignant tumors had no symptoms, and 33 per cent of the benign ones were symptomless. The symptoms were of very little help.

Dr. Paul (*closing*): I have appreciated very much hearing Dr. Hampton. His remarks point up the fact that there is still a good deal of controversy about this lesion, pulmonary adenomatosis, and there probably will continue to be for some time to come. A very competent group of histologists and pathologists have disagreed in the past and continue to disagree. As a matter of fact, there is disagreement among the pathologists on my own staff, so that we have taken our present stand only after some thought. It is entirely possible that we will change our opinion as we acquire more experience.

Dr. Lemon (*closing*): I agree with Dr. Hampton, completely, about the possible presence of calcification in some of these cases, and it is likely that tomography would have demonstrated calcification which was not apparent in our roentgenograms. Nevertheless, though well circumscribed lesions containing calcium of the type described are most suggestive of hamartoma, we are still reluctant to make an unqualified diagnosis; we are especially uncertain whether we can exclude the possibility of a tuberculoma. Therefore, in our present state of knowledge, we believe it is only safe to recommend an exploratory thoracotomy.

Aberrant Pancreatic Tissue in the First Portion of the Duodenum[1]

MICHAEL LITTNER, M.D.
Hines, Ill.

THE PRESENCE OF pancreatic tissue in an aberrant location is being reported with increasing frequency and can no longer be considered a rare postmortem or surgical finding. Such tissue, moreover, is often responsible for symptoms, which are sometimes severe. A recent classic review and contribution to the subject from the Mayo Clinic lists 21 of 41 histologically authenticated cases as having been clinically significant (1).

The formation of aberrant (accessory or heterotopic) pancreatic tissue is usually considered to be due to defective embryologic development. Horgan (2) believed that during early development the branching ducts of the body of the pancreas become engrafted on contiguous organs during the migration of the latter and before the coalescence of the primitive pancreatic anlagen, and that this graft is pulled off and forms an intramural mass. Warthin (3) held that the rudimentary pancreatic ducts penetrate the intestinal wall by lateral budding and are separated by longitudinal growth of the intestine. The possibility that the aberrant tissue is due to anaplasia of intestinal mucous membrane may also be mentioned, but only for the sake of completeness.

The aberrant pancreatic tissue is usually in the form of a single firm nodule, measuring about 1.0 to 4.1 cm. in diameter. It is most commonly found beneath the mucous membrane and frequently infiltrates the muscle fibers. The nodule is usually sessile; it may be lobulated and present a granular surface. The appearance on cut section is glandular, and the color is white to yellow.

Fig. 1. Filling defect in the partially empty bulb due to aberrant pancreatic tissue.

CASE REPORT

T. B. S., a 24-year-old white male, was admitted to the hospital March 17, 1949, complaining of heartburn and dull epigastric pain occurring shortly after meals. In 1943, while in the Army in North Africa, he had been hospitalized for three weeks, following constipation for one week and an episode of severe vomiting. Subsequently the present symptoms developed. The patient complained of the frequent passage of gas, orally and rectally, especially after eating fried and greasy foods. He was taking milk of magnesia after each meal to relieve his "indigestion" and insure a daily bowel movement.

In 1945, the patient had been given a 60 per cent disability discharge from the Army for hepatitis, psychoneurosis, and right renal stones. Cystoscopy had since been done at two hospitals, and there is a possibility that stones were removed. Two weeks before admission a diagnosis of polyp of the first part of the duodenum was made on two different occasions, in another hospital.

---

[1] From the Radiological Service (Samuel Richman, M.D., Chief), Veterans Hospital, Richmond, Va. Sponsored by the VA and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are a result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

Accepted for publication in February 1950.

The patient appeared well nourished and, except for slight epigastric tenderness, physical examination was not significant. The laboratory findings, including liver function tests and gastric analysis, were within normal limits. The blood pressure was 140/88. No tests were done for pancreatic function.

A barium meal study on March 22 revealed a sharply outlined, oval defect measuring about 1.5 cm. in diameter in the duodenal bulb (Figs. 1 and 2). *The defect showed no mobility.* The involved area was tender. The remainder of the duodenum appeared normal. A cholecystogram was also normal. While the roentgen findings suggested a polyp of the duodenal bulb, the Medical Service considered the lesion to represent a hyperplasia of Brunner's glands rather than a true polyposis, because of the moderate amount of hydrochloric acid after the test meal.

Laparotomy was done on April 6, revealing an intramural nodule about 1.0 × 0.5 cm. in the anterior wall of the first portion of the duodenum, some 2.0 cm. from the pyloric ring. The lesion was excised and the duodenum was closed transversely. Slight improvement followed, and after twenty days the patient was discharged. Symptoms persisted two months later and were considered functional. Re-examination with a barium meal, April 22, showed deformity of the duodenal bulb.

Pathological examination was done by Dr. Simon Russi, Chief of the Pathology Department, who described the specimen as a piece of pinkish tissue measuring about 2 × 1 × 2 cm., one surface of which was covered by mucous membrane and the other by serosa. The appearance on cut section was glandular. Microscopically nests of pancreatic tissue, including acini, ducts, and islets, were seen extending from the submucosa and through the muscularis (Fig. 3). Some of the tissue was trapped between muscle bundles. There was no evidence of malignant change.

The diagnosis was "heterotopic pancreas (accessory pancreas)."

Fig. 2. Magnified spot film without pressure, showing the complete outline of the bulb.

DISCUSSION

While it may appear arbitrary in this case to make a regional diagnosis, specifying the first portion of the duodenum, it is felt that this is justifiable because of the higher frequency of disease in that location as compared with the remainder of the duodenum.

Feldman (4) states that benign tumors occur most often in the first portion of the duodenum. It might be expected, therefore, that a benign tumor, such as an adenoma or a polyp, or hypertrophy of Brunner's glands, would be most frequently thought of in the presence of a filling defect due to aberrant pancreas at this site. Actually duodenal ulcer is the most common diagnosis. The first portion of the duodenum may appear merely deformed and, of course, statistically the odds are in favor of ulcer.

In only one of 7 cases of aberrant pancreas in the duodenum reported by de-Castro Barbosa, Dockerty, and Waugh (1) was the diagnosis of tumor made. In all the others the roentgen diagnosis was duodenal ulcer, although in but one was an ulcer actually present, contiguous to the heterotopic tissue.

We know of no case mistaken for prolapsed gastric mucosa, but it is easily conceivable that a lobulated nodule of pancreatic tissue situated in the juxtapyloric region might simulate that condition. Deformity of the pylorus, with indentation of the base of the bulb by the lobulated defect would favor a diagnosis of prolapsed mucosa.

The most difficult differential diagnosis seems to us to be between a benign mucosal mass such as a polyp and the intramural pancreatic nodule which produces a defect in the barium shadow by indenting the duodenal mucosa. Mobility of the filling defect would as a rule be a point against aberrant pancreas, though lack of mobility,

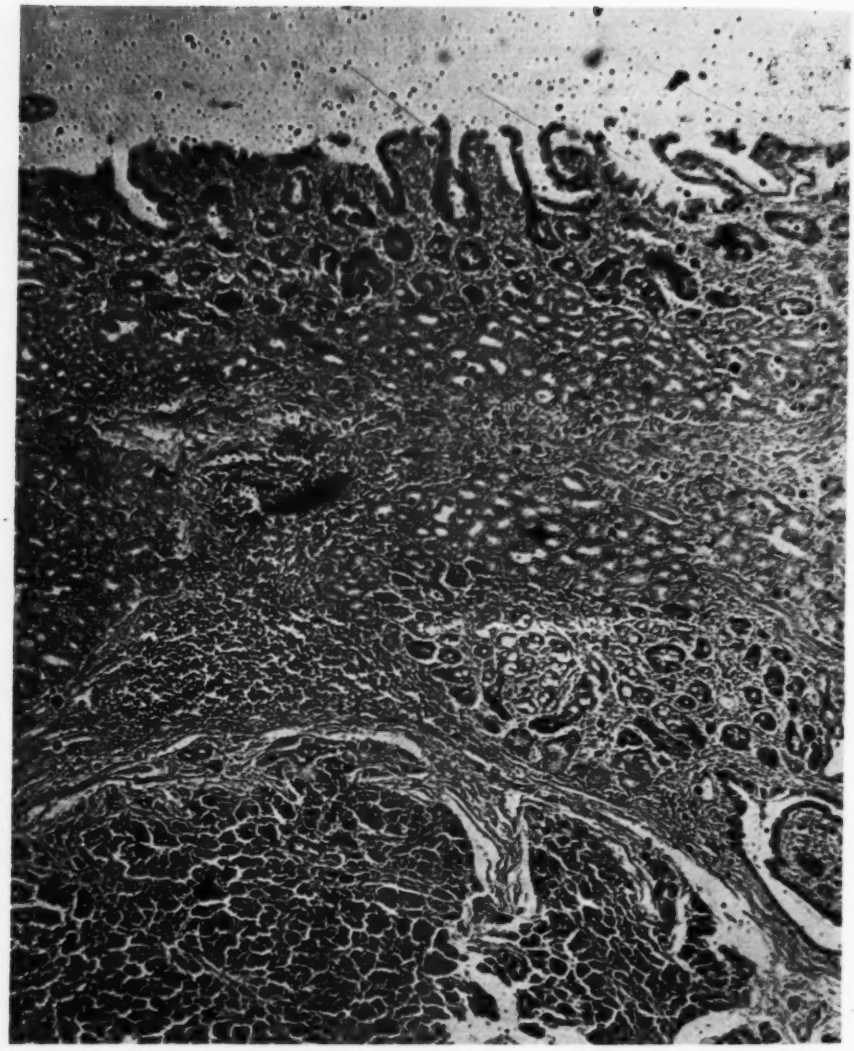


Fig. 3. Photomicrograph through a section of the bulb, showing the intramural aberrant pancreatic tissue.

such as occurred in our case, would not rule out a polyp with a very short pedicle.

A history of hyperinsulinism would favor aberrant pancreas, especially when upon laparotomy an adenoma cannot be found in the pancreas proper.

SUMMARY

Aberrant pancreatic tissue is most commonly regarded as due to a developmental error. Its occurrence in the first portion of the duodenum is not rare and often produces symptoms.

The aberrant tissue is usually in the form of a single sessile, intramural nodule, of glandular appearance on section. Roentgenologically it has been confused most commonly with ulcer, probably because the filling defect may simulate a deformed bulb. A case is presented in

which an erroneous diagnosis of polyp was made on the basis of the roentgen findings.

Aberrant pancreatic tissue should be considered among the possibilities when one encounters a filling defect in the first portion of the duodenum. Other benign lesions cannot be ruled out on purely radiological grounds, although the clinical findings may be suggestive.

Hines Veterans Administration Hospital
Hines, Ill.

REFERENCES

1. BARBOSA, J. J. DECASTRO, DOCKERTY, M. B., AND WAUGH, J. M.: Pancreatic Heterotopia: Review of Recent Literature and Report of 41 Authenticated Surgical Cases, of Which 25 Were Clinically Significant. Surg., Gynec. & Obst. **82:** 527–542, May 1946.

2. HORGAN, E. J.: Accessory Pancreatic Tissue. Arch. Surg. **2:** 521, May 1921.

3. WARTHIN, A. S.: Two Cases of Accessory Pancreas (Omentum and Stomach). Physician and Surgeon **26:** 337–350, August 1904.

4. FELDMAN, M.: Clinical Roentgenology of the Digestive Tract. Baltimore, Williams & Wilkins Co., 2d ed., 1945.

SUMARIO

Tejido Pancreático Aberrante en la Primera Porción del Duodeno

El tejido pancreático aberrante pasa habitualmente por ser debido a un vicio de desarrollo. Su existencia en la primera porción del duodeno no es rara y a menudo provoca síntomas.

El tejido aberrante suele tomar la forma de un nódulo intramural, sésil, solitario, de aspecto glandular al corte. Roentgenológicamente, ha sido confundido más frecuentemente con úlcera.

Preséntase una historia clínica en la que el tejido aberrante fué tomado roentgenológicamente por pólipo.

El tejido pancreático aberrante debe ser considerado entre las posibilidades al encontrar un nicho en la primera porción del duodeno. Otras lesiones benignas no pueden ser excluídas a base de datos puramente radiológicos, aunque los hallazgos clínicos pueden resultar indicativos.

Extreme Retardation of Epiphyseal Growth from Roentgen Irradiation

A Case Study[1]

CHARLES H. FRANTZ, M.D.

Grand Rapids, Mich.

EXTREME VARIATION in leg length is both disabling and distressing. Seldom does one encounter this situation as the result of x-irradiation.

The inhibiting and destructive effects of roentgen rays on epiphyseal cartilage have been demonstrated in the animal by a number of investigators. During the first decade of the twentieth century Perthes, Recamier and Tribondeau, Forsterling and Krukenberg subjected numerous small animals to irradiation, demonstrating that exposure to x-rays caused more or less retardation in the growth of bones and other structures. In general, it was determined by these investigators that the degree and duration of growth inhibition were governed by the age of the animal and the dosage.

In late years, detailed animal studies, well controlled, have been conducted by Barr and his associates (1, 7), Bisgard and Hunt (2), Brooks and Hillstrom (3), Regen and Wilkins (6). Their observations demonstrate without question that bone growth in the young can be retarded or stopped by a sufficient dosage of x-ray. The microscopic picture of the epiphysis following irradiation is that of chondrocyte degeneration — diminished numbers of primitive chondrocytes, a disruption of the orderly arrangement of cartilage columns and abnormal foci of calcification away from the normal metaphyseal location. No significant evidence of growth stimulation has been observed, and the picture of cartilage regeneration has been inconsequential. Barr and Bisgard and Hunt have called attention to the insults to the hemopoietic system in the metaphyses as revealed by the fibrous character of the marrow space.

Careful measurements of long bones following exposure reveal not only less length than normal but decrease in shaft diameter and cortical thickness. The changes noted in hyaline joint cartilage are apparently insignificant from a clinical standpoint.

The literature does not divulge a large number of cases in which longitudinal growth was followed after therapeutic irradiation about the epiphyses. Desjardins (4) reported the case of a nine-year old girl irradiated for a tumor of the upper humerus. The total dosage was not recorded. Five years following treatment there was marked shortening of the humerus with atrophy of the shoulder musculature. Stevens (9) over a period of two months gave a four-month-old child 1,816 r for a nevocarcinoma of the left thigh, lower abdomen, and vulva. The tumor was successfully controlled, but at the age of four years the left limb measured two inches shorter than the right. In the face of this retarded growth, Stevens urged great care in irradiating infants.

Judy (5), in a preliminary report, described changes effected in three children submitted to irradiation in an attempt to correct asymmetry in the length of the lower extremities. The ages were five to eight years, and the discrepancy between the two limbs $1^1/_4$ to 3 inches. Fractionated doses of roentgen rays were given to the longer limb over periods of twelve to twenty-eight months, with total dosages of 3,600 to 4,400 r. In each instance the irradiation was found to have exerted a deterrent effect on bone growth.

Spangler also used irradiation in children with shortening of one leg in a deliberate attempt to bring about epiphyseal closure in the longer limb thus correcting the

[1] From the Orthopedic Service of Blodgett Memorial Hospital, Grand Rapids, Mich. Accepted for publication in January 1950.

asymmetry. He treated four children of eight to twelve and a half years with discrepancies of $1^1/_4$ to $3^1/_2$ inches. The dosage used was from 2,656 to 4,353 r. Roentgen evidence of epiphyseal closure was obtained in two cases. In a third case, in which the roentgenograms showed only incomplete closure, a Phemister procedure was done and tissue was fortunately obtained. The microscopic findings are well demonstrated in his presentation (8). They indicated physiologic closure but without enough change to be demonstrable roentgenographically. Spangler came to the conclusion that more satisfactory results would be obtained with treatment between the ages of six and ten years.

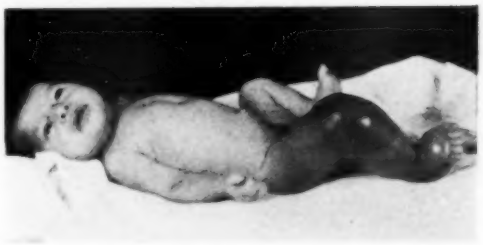


Fig. 1. Patient at age of three weeks, with hemangioma involving right lower extremity.

was taken to the University Hospital at Ann Arbor, Mich., where a biopsy was done, with a diagnosis of hemangioma hypertrophicum. Six days following the biopsy a course of irradiation was initiated. The factors were: 135 kv., 5 ma., filtration 4.0 mm. Al, focal skin distance 30 cm. Treatment was given as follows:

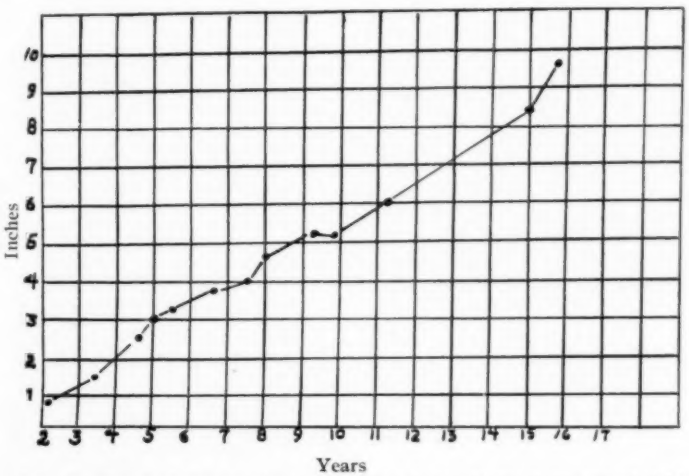


Fig. 2. Graph demonstrating gradual lag in longitudinal growth of right leg and measured discrepancy in lower limbs. At two years of age, right leg 3/4 inch short; at fifteen years, 9 3/4 inches short.

It would appear from these clinical observations that infants tolerate smaller doses of radiation than older children. The following case observed in this Clinic for thirteen years is further evidence in support of this assumption.

Date	Field	Site	Dose (r in air)
Oct. 17, 1933	15 × 15 cm.	Leg: medial	400 r
Oct. 18, 1933	15 × 15 cm.	Leg: lateral	400 r
Nov. 16, 1933	15 × 15 cm.	Leg: medial and lateral, each	200 r
Dec. 12, 1933	15 × 15 cm.	Leg: medial and lateral, each	200 r
Jan. 23, 1934	10 × 10 cm.	Leg: medial and lateral, each	200 r
March 10, 1934	10 × 10 cm.	Lower thigh: medial and lateral, each	200 r

CASE REPORT

N. B. was first seen in the Orthopedic Clinic in July 1936 at the age of two years and ten months, with a short right leg. The child was born with a large "blood tumor" of the right thigh and leg, extending down to and including the dorsum of the foot (Fig. 1). At the age of two and a half weeks he

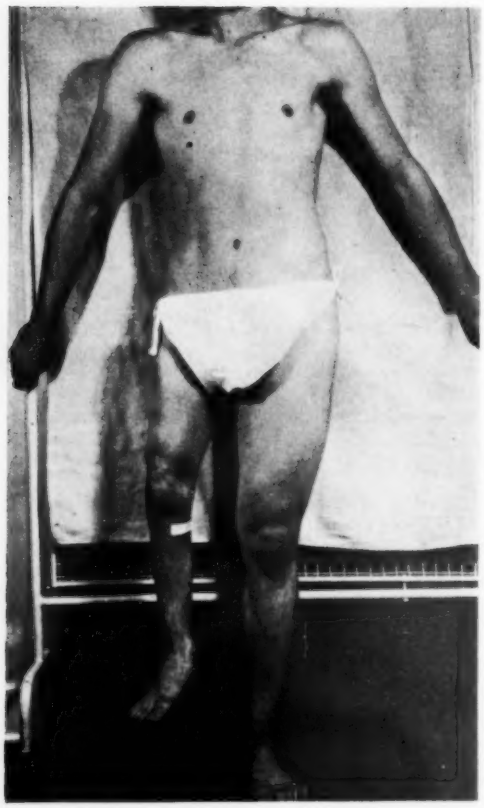


Fig. 3. Patient at age of fifteen, with 9 1/2 to 10 inches shortening of the right leg, clinically (corrected roentgen measurement 25 cm.). Soft tissues are markedly atrophied.

One week following the final exposure, a Lovett cast was applied for a flexion deformity of the right knee. Subsequently, over a period of two months, three stretching plasters were necessary to bring the knee into extension. A brace was then applied, which was worn until the patient was two years old (July 1935). At this date it was determined that there was a shortening of the right leg of 3/4 inch. There were complete solution of the hemangioma, good skin texture about the irradiated area, and normal knee joint motion. The parents at this time were advised to return with the patient in one year for a clinical check-up.

The child was not taken back to the University Hospital, however, but was seen at this clinic. He was a healthy boy of about three years, with positive findings limited to the right lower extremity, which was found to be 1 1/2 inches shorter than the left. The right calf measured 1 inch less in circumference than the left and the right thigh 2 inches less in circumference than the left. Knee joint motion was normal and the skin was of good texture. The child was fitted with new footgear, with an appropriate lift to the right shoe.

The patient was seen at fairly regular intervals and clinical measurements were taken. There was a definite lag in longitudinal and circumferential growth. In August 1947, at the age of fourteen

Fig. 4. Composite roentgenogram showing extreme shortening of right femur and tibia and closed epiphyses.

years, a swelling was noted in the popliteal space of the right leg. Roentgenograms disclosed an exostosis on the posterior surface of the right femur 8 cm. above the condyles. This was removed and an uneventful convalescence followed. The Pathology Department reported a benign osteochondroma.

The patient has continued to report to the clinic for measurements and footgear with gradually increasing lifts to the right shoe. The lag in growth of the right leg has been constant, and in March 1949 a clinical measurement of 9 3/4 inches shortening was recorded (Fig. 2). At this time the right calf measured 6 inches less in circumference than the left, and the right thigh 7 3/4 inches less in circumference than the left (Fig. 3). Roentgen measurements of tibial-femoral lengths were recorded as follows: right femur, 37.7 cm.; left femur, 51.3 cm.; right tibia, 26.0 cm.; left tibia, 37.5 cm.; a total shortening of 25.1 cm. on the right side. At midshaft: right femoral diameter, 2.7 cm.; left femoral diameter 3.2 cm.; right tibial diameter, 2.2 cm.; left tibial diameter, 2.8 cm. (Fig. 4).

The patient is now sixteen years of age and is very conscious of his deformity. In the presence of normal knee function he is seeking a below-knee amputation.

DISCUSSION

The prolonged effect of irradiation is well demonstrated in this case. The initial treatment was directed against a massive hemangioma and was entirely successful. There was little choice in the method. After a period of fifteen and one-half years, however, there has resulted a 29 per cent lag in longitudinal growth of the treated extremity. The thigh and calf circumferences on the irradiated side are much less than for the normal opposite member. The midshaft diameters of the long bones exposed are less than normal. Of interest is the fact that normal knee joint motion has persisted and roentgen studies reveal a normal joint space. Apparently there has been no significant change in the hyaline cartilages about the knee joint.

The retardation of physiological growth is quite evident. The epiphyses about the knee contribute 67 per cent of longitudinal growth, but in this case there is only 29 per cent lag. Whether or not the upper femoral and lower tibial epiphyses accelerated their respective contributions to the total limb length is conjectural. Barr and his co-workers found this to be true in dogs and offered no explanation for the stimulation. At the ages of five and nine years the epiphyses were open and the roentgen picture revealed them to have an arcuate curve. The metaphyseal area showed a band of increased density and at the juxta-epiphyseal area the trabeculations were indistinct (Fig. 5). The longitudinal measurement of tibia in these films is less than the length recorded in the films of March 1949 (Fig. 4), substantiating the fact that physiological growth continued but at a markedly slow rate. Unfortunately, one cannot demonstrate at exactly what age the epiphyses closed from a roentgen standpoint. It can only be said that the closure occurred before the age of fifteen years.

This case does not differ from those reported by other observers. However, the

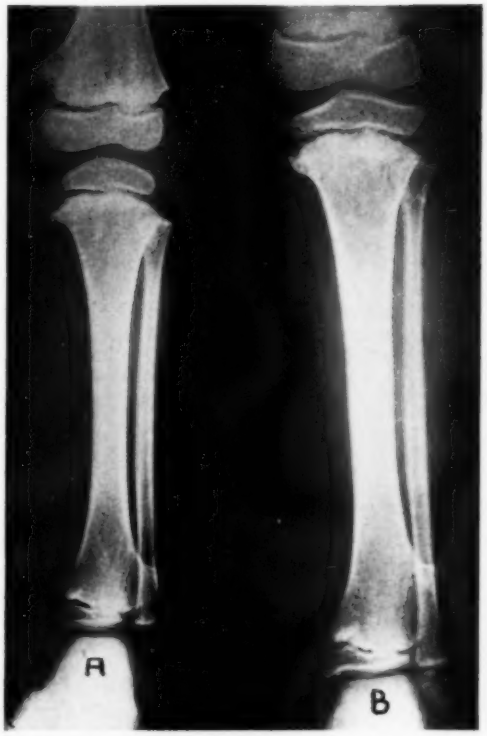


Fig. 5. The epiphyses show an arcuate curve. The metaphyseal area is increased in density and the juxta-epiphyseal area shows indistinct trabeculations. A. At five years, 14.8 cm. B. At nine years, 18.4 cm.

long time follow-up and the excessive shortening through the years serve to warn of the dangers of irradiation in infants and to indicate the late complications which fall in the orthopedic field. The problem now presented is purely orthopedic in nature and will probably be solved by a below-knee amputation and a conventional below-knee prosthesis.

NOTE: I express my appreciation to Dr. Fred J. Hodges, radiologist at the University Hospital, Ann Arbor, Mich., for the detailed information on irradiation in this case.

Wealthy St. at Plymouth Road
Grand Rapids 6, Mich.

REFERENCES

1. BARR, J. S., LINGLEY, J. R., AND GALL, E. A.: Effect of Roentgen Irradiation on Epiphyseal Growth. I. Experimental Studies Upon the Albino Rat. Am. J. Roentgenol. **49:** 104–115, January 1943.

2. BISGARD, J. D., AND HUNT, H. B.: Influence of Roentgen Rays and Radium on Epiphyseal Growth of Long Bones. Radiology **26:** 56–64, January 1936.

3. BROOKS, B., AND HILLSTROM, H. T.: Effect of Roentgen Rays on Bone Growth and Bone Regeneration. An Experimental Study. Am. J. Surg. **20:** 599–614, June 1933.

4. DESJARDINS, A. U.: Osteogenic Tumor: Growth Injury of Bone and Muscular Atrophy Following Therapeutic Irradiation. Radiology **14:** 296–307, March 1930.

5. JUDY, W. S.: An Attempt to Correct Asymmetry in Leg Length by Roentgen Irradiation. Preliminary Report. Am. J. Roentgenol. **46:** 237–240, August 1941.

6. REGEN, E. M., AND WILKINS, W. E.: Effect of Large Doses of X-rays on Growth of Young Bone. J. Bone & Joint Surg. **18:** 61–68, January 1936.

7. REIDY, J. A., LINGLEY, J. R., GALL, E. A., AND BARR, J. S.: Effect of Roentgen Irradiation on Epiphyseal Growth. II. Experimental Studies Upon the Dog. J. Bone & Joint Surg. **29:** 853–873, October 1947.

8. SPANGLER, D.: Effect of X-ray Therapy for Closure of Epiphyses. Preliminary Report. Radiology **37:** 310–314, September 1941.

9. STEVENS, R. H.: Retardation of Bone Growth Following Roentgen Irradiation of an Extensive Nevo-Carcinoma of the Skin in an Infant Four Months of Age. Radiology **25:** 538–544, November 1935.

SUMARIO

Sumo Retardo del Crecimiento Epifisario Debido a la Irradiación Roentgen Estudio de un Caso

Un niño fué tratado por primera vez a la edad de tres semanas con rayos X por hemangioma de la pierna derecha. En un período de cinco meses se administró una dosis total de 2,400 r a través de campos mediales y laterales. El tumor desapareció completamente, pero a la edad de tres años, la pierna irradiada reveló, comparada con la izquierda, un acortamiento de 3.75 cm.; la pantorrila derecha medía 5 cm. menos de circunferencia que la izquierda y el muslo derecho 5 cm. menos que el izquierdo. Esa demora en el desarrollo ha continuado hasta que, a la fecha de esta comunicación, hay una diferencia de unos 24 cm. en el largo de las piernas, de 15 cm. en la circunferencia de las pantorrilas y de unos 19 cm. en la de los muslos.

Value of Hysterography in the Diagnosis of Large Submucous Uterine Fibroids[1]

RICHARD H. MARSHAK, M.A., M.D., MORRIS A. GOLDBERGER, M.D., and WILLIAM A. EPSTEIN, M.D.
New York, N. Y.

HYSTEROGRAPHY can be valuable in the diagnosis of large submucous fibroids. These tumors, when they occupy the entire uterine cavity, form a false smooth wall and are difficult to detect by curettage. In the cases to be reported here, curettage was done for menometrorrhagia by different gynecologists without disclosing the nature of the lesion. Because bleeding continued, hysterography was performed and a large submucous fibroid was found in each instance.

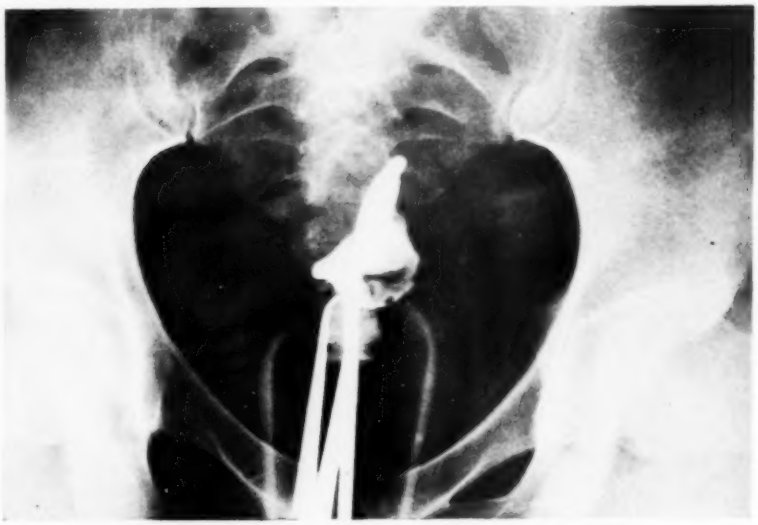


Fig. 1. Case I. Hysterogram obtained with skiodan acacia, showing a globular, retroverted uterus with a mass filling the entire cavity.

CASE REPORTS

Case I: R. P., a 27-year-old nullipara, was first seen on May 27, 1948, complaining of irregular bleeding for the last eighteen months. Her menses started at the age of thirteen and until the present illness occurred every thirty days, lasting six days. Treatment had consisted mainly of hormones, administered by mouth, without any effect. The basal metabolism rate, determined three months before admission, was −25 per cent. Three grams of thyroid were administered daily with no effect on the menometrorrhagia, and a repeat basal metabolism test on May 2, 1948, showed a rate of −6 per cent.

Physical examination revealed no evidence of any abnormality except for the pelvic findings. The cervix was eroded; the uterus was not enlarged but was retroverted. On June 29, 1948, a diagnostic curettage was performed and a small amount of tissue was obtained. No irregularity of the uterine cavity was noted. Microscopic examination revealed proliferative endometrium, and the patient was discharged on July 1 in good condition. Two weeks later bleeding again started. Ergotrate and Oreton were administered, with slight diminution of the bleeding. After three months of intermittent spotting, a hysterogram (Fig. 1) was obtained on Oct. 11. This showed the uterine cavity to be globular in outline, retroverted, and normal in size. A filling defect occupied the entire cavity and a presumptive diagnosis of submucous fibroid was made. On Oct.

[1] From the Department of Radiology and Gynecology, Mount Sinai Hospital, New York. Accepted for publication in January 1950.

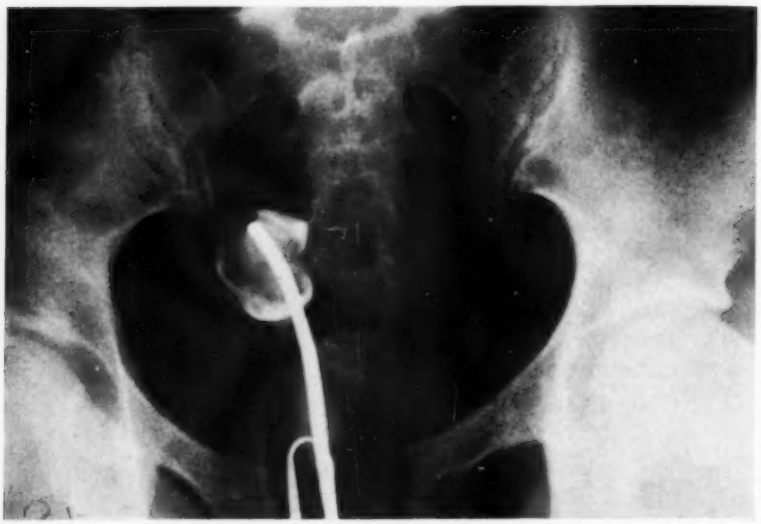


Fig. 2. Case II. Hysterogram obtained with skiodan acacia. The uterus is globular and is filled by a space-occupying mass. *Impression:* Submucous fibroid.

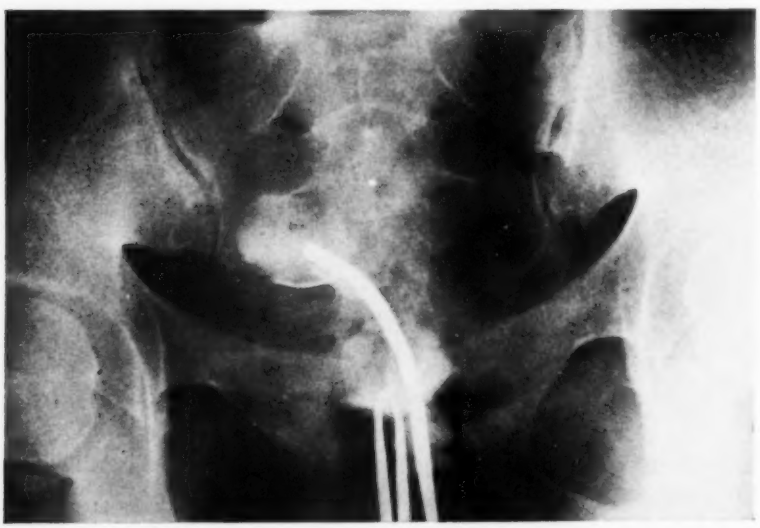


Fig. 3. Case III. Hysterogram obtained with rayopaque, showing slightly enlarged uterine cavity filled with a submucous fibroid.

16, the patient was prepared for a vaginal hysterotomy. Prior to this operation, a second diagnostic curettage, performed by a different operator, again revealed no evidence of an intrauterine lesion. When the cervix was incised and a finger introduced into the uterus, a submucous fibroid the size of a walnut was detected. It was attached to the posterior wall by a broad pedicle. This was excised and the patient made an uneventful recovery.

Follow-up examination revealed a well healed cervix that readily admitted a uterine sound. Since operation, there has been no abnormal bleeding.

Case II: A. L., a 25-year-old nullipara, was first seen on Jan. 14, 1949, complaining of considerable bleeding for the last two weeks, with the passage of clots. In March 1948 there had been a similar episode, for which a diagnostic curettage was performed.

There was no evidence of any intrauterine tumor, and a diagnosis of functional bleeding was made. Hormones by mouth were administered at that time to check the bleeding, but without success. The hemoglobin was 54 per cent.

Physical examination was entirely negative except for a slightly enlarged globular uterus. A submucous fibroid was suspected, and a hysterogram (Fig. 2), obtained on Jan. 20, showed the uterine cavity to be slightly enlarged, globular in outline, with a filling defect occupying the entire cavity. A diagnosis of submucous fibroid was made and on Feb. 3, after two (500 c.c.) blood transfusions, a laparotomy was performed. The uterus was symmetrical and slightly enlarged. An incision was made through the anterior wall into the uterine cavity and a mass the size of a golf ball was excised. The postoperative course was uneventful. The pathologist described the tumor as an adenomyotic nodule. The patient has been well since the operation.

Case III: M. N., a 22-year-old nullipara, was first seen on Oct. 2, 1948, complaining of continuous bleeding for the last six weeks with occasional passage of clots. Her past history was essentially negative.

Physical examination revealed a slightly enlarged uterus. A diagnostic curettage was performed, and a small amount of tissue obtained. There was no evidence of an intrauterine tumor. The microscopic report revealed proliferative endometrium. Beginning two weeks following the curettage, the patient bled continuously for three weeks. A hysterogram (Fig. 3) revealed a filling defect, most likely due to a submucous fibroid. Again, prior to vaginal hysterotomy, an additional curettage was performed by two different operators, who noted no abnormality. The pathological report was fibromyoma.

CONCLUSIONS

Three cases are presented in which curettage done because of abnormal bleeding showed no evidence of any tumor within the uterine cavity. A subsequent hysterogram, however, revealed a submucous tumor. The failure of the curettage to reveal the tumor is explainable, since the submucous fibroid occupied the entire uterine cavity and formed a false smooth wall which would not be differentiated from the normal uterine wall by the operator. Hysterography establishes the diagnosis in this type of case. Rayopaque and skiodan acacia were the contrast media employed. No ill effects were observed from the use of the drugs in this series.

1075 Park Ave.
New York 28, N. Y.

REFERENCES

GOLDBERGER, M. A.: Clinical Evaluation of Hysterography. J. Mt. Sinai Hosp. **10:** 241–249, May–June 1943.

RUBIN, I. C., AND BENDICK, A. J.: Uterotubal Roentgenography with Lipiodol. Am. J. Roentgenol. **16:** 251–255, September 1926.

RUBIN, I. C.: X-ray Demonstration of Submucous Myomas by Combined Use of Hippuran and CO_2 Injection. Am. J. Obst. & Gynec. **37:** 75–85, January 1939.

SUMARIO

El Valor de la Histerografía en el Diagnóstico de los Grandes Fibromas de la Submucosa Uterina

En los tres casos comunicados el legrado ejecutado por metrorragia anormal no reveló signos de tumor intrauterino, pero la histerografía subsiguiente con rayopaco o goma arabiga con skiodán mostró la presencia de un fibroma submucoso. En los tres casos, el tumor ocupaba toda la cavidad uterina, formando una pared lisa, que, con el raspado, no podía diferenciarse de la pared uterina normal. En esos casos, la histerografía resulta valiosa para establecer el diagnóstico. No se observaron efectos contraproducentes debidos a los medios de contraste empleados.

Gastric Ulcer in Childhood

Report of a Case[1]

JAMES F. MARTIN, M.D.,[2] and HENRY F. SAUNDERS, M.D.
Cleveland, Ohio

THE ROENTGEN examination of the stomach and duodenum in infancy and childhood is usually concerned with congenital developmental abnormalities, hypertrophic pyloric stenosis, foreign bodies, and inflammatory lesions. Gastric ulcer is a rare condition in children, as indicated by the paucity of case studies in the literature, and its occurrence warrants reporting. It is to be expected that an increasing number of gastric and duodenal ulcers will be identified with more frequent use of radiographic diagnostic procedures in this group of patients.

Foshee (2), in a review of the literature, found 18 cases of gastric ulcer in infants and children and added one of his own. Eleven of this series were diagnosed at surgery, 5 at autopsy, and 3 were identified by radiographic studies. Logan and Walters (3), in 1941, reported an additional 15 cases, in 12 of which radiographic studies were used in identifying the lesion. Bird, Limper, and Mayer (1), in an excellent review of the world literature, reported a total of 59 cases of gastric ulcer before the age of fifteen years as compared to 184 duodenal ulcers in a similar period. They further divided their cases into age groups, showing that only 6 cases of gastric ulcer were identified in patients from two to six years, while 16 have been reported between seven and eleven years of age.

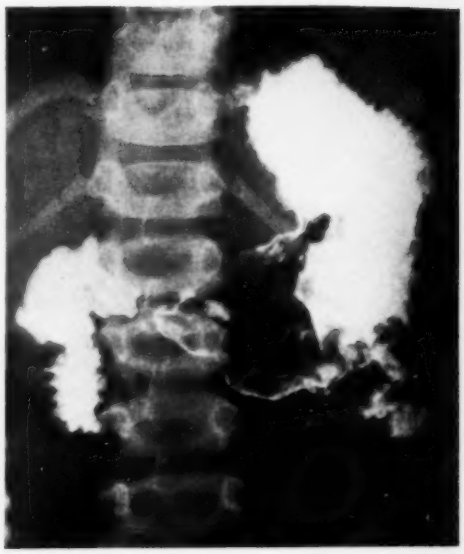


Fig. 1. Gastric ulcer 1 cm. in diameter on the lesser curvature of the prepyloric antrum as it appeared on Aug. 7, 1948.

CASE REPORT

J. S., a white boy aged 6 years and 4 months, was admitted to Babies and Childrens Hospital of University Hospitals on Aug. 4, 1948, because of intermittent, vague, generalized abdominal pain of one week duration. This was associated with nausea, anorexia, and general malaise. There had been four episodes of vomiting beginning three days prior to admission. The vomitus was described as containing "black gravel." The stool was examined prior to admission to the hospital by one of us (H. F. S.) and was found to be distinctly tarry, with a 4+ benzidine test. There was no fever, diarrhea, or history of bleeding tendency. The past history was non-contributory, and there was no history of ulcer in the family.

The patient appeared well developed and well nourished, in no distress, and not acutely ill. His color was good, and there were no signs of hemorrhage in the skin or mucous membranes. Mild epigastric tenderness could be elicited on palpation of the abdomen. The temperature was 37.8° C., the pulse rate 108 per minute, respirations 18 per minute, blood pressure 140/80.

The red cell count was 4,280,000, and the white cell count 13,100, with 70 per cent segmented neutrophils, 10 per cent stab cells, 14 per cent lymphocytes, 5 per cent monocytes, and 1 per cent eosinophils. Platelets numbered 265,200. The bleeding time was

[1] From the Departments of Radiology and Pediatrics of Western Reserve University Medical School and Babies and Childrens Hospital of University Hospitals of Cleveland. Accepted for publication in February 1950.
[2] Now at the Bowman Gray School of Medicine, Wake Forest College, Winston-Salem, N. C.

2 minutes and 30 seconds; the clotting time 4 minutes and 55 seconds. The blood non-protein nitrogen was 31 mg. per 100 c.c. The blood Wassermann and Pangborn reactions were negative. The urine was normal except for a 4+ acetone reaction on admission, which disappeared on the second hospital day. The old tuberculin reaction, 1:1,000, was negative. The vomitus was positive for occult blood.

Roentgen studies of the upper gastro-intestinal tract on Aug. 7 revealed an ulcer niche 1 cm. in diameter on the lesser curvature of the stomach, 2 cm. proximal to the pylorus. The rugae radiated from

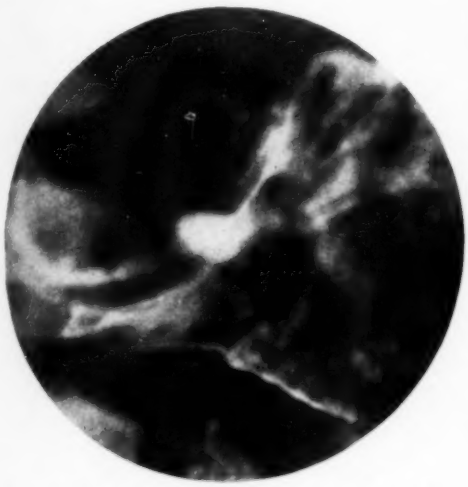


Fig. 2. Spot roentgenogram of the prepyloric region. The large fleck of barium represents the ulcer niche as it appeared on Aug. 7, 1948.

the niche in cart-wheel fashion. Moderate spasm and tenderness to palpation were present in the prepyloric region. The esophagus and duodenum were normal. Figures 1 and 2 demonstrate the ulcer niche.

The patient complained of mild generalized abdominal pain for the first two hospital days. During this period, he vomited only once, the vomitus containing streaks of bright red blood. He had one tarry stool on the first hospital day. An ulcer regimen was instituted on the second hospital day, consisting of increasing amounts of equal parts of milk and 16 per cent cream, two teaspoons of amphojel with mineral oil every two hours, and 2 minims of tincture of belladonna three times a day. Strained foods were added to the diet on the fourth hospital day. The patient was discharged much improved on the seventh day.

The roentgen study was repeated on Aug. 27, 1948, at which time the ulcer niche measured 4 mm. in diameter. Re-examination on Sept. 20 failed to

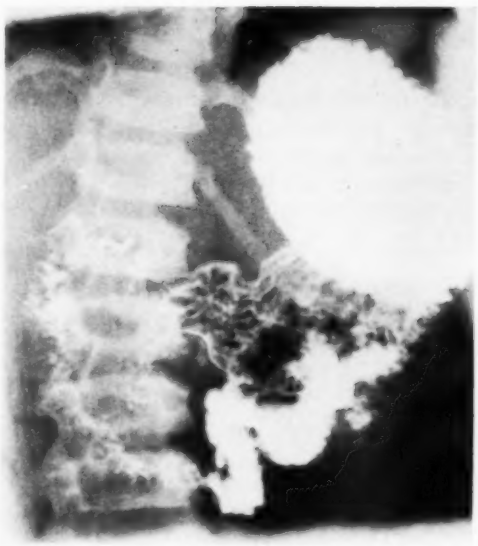


Fig. 3. Roentgenogram of the stomach demonstrating the mucosal pattern of the prepyloric region, with residual deformity of the rugal folds, Sept. 20, 1948.

reveal any evidence of ulcer. The spot film (Fig. 3) demonstrates the residual distortion of the mucosal pattern in the preplyloric region seen at this time.

SUMMARY

Acute gastric ulcer with hemorrhage is of rare occurrence in childhood. The clinical and radiographic findings in a case in a white boy of 6 years and 4 months are reported. The clinical aspects are essentially the same as those noted in similar cases in adult life. Medical therapy was effective in obtaining relief of the abdominal pain and healing of the ulcer.

Bowman Gray School of Medicine
Wake Forest College
Winston-Salem, N. C.

REFERENCES

1. BIRD, C. E., LIMPER, M. A., AND MAYER, J. B.: Surgery in Peptic Ulceration of the Stomach and Duodenum in Infants and Children. Ann. Surg. **114:** 526–542, October 1941.
2. FOSHEE, J. C.: Chronic Gastric Ulcer in Childhood: Report of a Case. J. A. M. A. **99:** 1336–1339, Oct. 15, 1932.
3. LOGAN, G. B., AND WALTERS, W.: Chronic Gastric Ulcer, in Childhood, Treated Surgically. Ann. Surg. **113:** 260–263, February 1941.

(Para el sumario en español, véase la página siguiente.)

SUMARIO

Úlcera Gástrica en la Infancia. Observación

La úlcera gástrica aguda es rara en la niñez. Los hallazgos clínicos y radiográficos aquí expuestos corresponden a un caso en un niño blanco de seis años y cuatro meses de edad. Las fases clínicas vienen a ser idénticas a las notadas en casos semejantes en personas adultas. La farmacoterapia resultó eficaz para obtener alivio del dolor abdominal y cicatrización de la úlcera.

Lymphosarcoma of the Kidney

A Case Report and Description of Roentgen Findings[1]

DAVID H. ALLEN, M.D., OWEN C. BERG, M.D., and WILLIAM ROSENBLATT, M.D.

Wichita Falls, Texas

LYMPHOSARCOMA of the kidney has been recorded many times since the original report in 1878 by Turner (6). Most of the cases have been secondary to massive involvement of retroperitoneal lymphoid tissue. There have been occasional reports of cases in which the lesions were largely or completely confined to the renal parenchyma and differentiation from primary disease of the kidney was not accomplished, the true nature of the process being recognized only after surgical or postmortem removal. Most of these cases have been unilateral and have been confused with primary renal neoplasms. A few instances of bilateral symmetrical renal involvement have been described. The clinical picture in these cases has been confusing, and no characteristic clinical or physical findings have been recorded by which the diagnosis was made prior to death or exploration.

It is the purpose of this paper to report a case of bilateral diffuse renal lymphosarcomatosis and to describe a roentgen finding which led the authors to suspect the diagnosis of this rare condition before death. This finding, it is believed, has not been described previously in renal lymphosarcomatosis.

CASE REPORT[2]

W. H., a white male, aged 41, was originally admitted to the Wichita General Hospital on June 8, 1948. About five months before admission he had fallen astride a board and injured the perineum; he remained well until two weeks following the accident, when he discovered a mass in the rectum. Since that time bowel movements had been difficult and pain in the rectum during defecation had become intolerable. The patient's earlier history and family history were not significant.

Findings on physical examination were essentially normal. There were no abdominal masses, nor was there any tenderness.

A proctologic examination revealed an ulcerated mass in the left margin of the anus. Palpation showed extension of this mass into the rectum, which was almost completely encircled by induration. The mass did not bleed but had a granular base with piled-up margins. A small biopsy taken from the edge was reported by the pathologist as showing solid sheets of roughly angular and ovoid pale cells, having large ovoid and hyperchromatic nuclei with prominent nucleoli. No definite stroma was found, and numerous mitotic figures were present. A diagnosis of "reticulum-cell sarcoma (lymphosarcoma)" was made.

Routine laboratory examinations disclosed no abnormal findings. The leukocyte count was 8,200, with 32 per cent lymphocytes and 57 per cent segmented forms. No immature forms were noted. Urinalysis revealed only a trace of albumin and 15 to 20 white cells per high power field.

The patient was transferred to the M. D. Anderson Cancer Research Hospital in Houston, Texas, on July 6, 1948, where the only additional finding was several discrete nodes in the inguinal regions. A biopsy taken from the rectal lesion showed only inflammatory tissue. On the basis of a review of the sections made in Wichita Falls, the hospital staff concurred in the diagnosis of reticulum-cell sarcoma of the rectum and a course of x-ray therapy was given.

The patient returned to his home late in July 1948, and was well until December, when he had an attack of severe cramping pain in the upper abdomen, accompanied by nausea and vomiting and lasting several days. In April 1949, there was a recurrence of these symptoms, and on readmission to the Wichita General Hospital, June 6, 1949, the patient stated that he had been vomiting after almost every meal, had lost weight, and suffered almost constant upper abdominal pain, which was particularly severe on the right. Palpation of the abdomen revealed a firm nodular mass in the upper right quadrant, measuring approximately 12 × 8 cm. This was freely movable, and moved with respiration. A similar but smaller mass was present in the left upper quadrant. No palpable masses were discovered on rectal examination.

Intravenous urography (Fig. 1) showed enormous enlargement of the kidneys. Both renal pelves

[1] From the Wichita County Medical Society Cancer Clinic and the Wichita General Hospital. Accepted for publication in March 1950.

[2] No. 281577, Armed Forces Institute of Pathology.

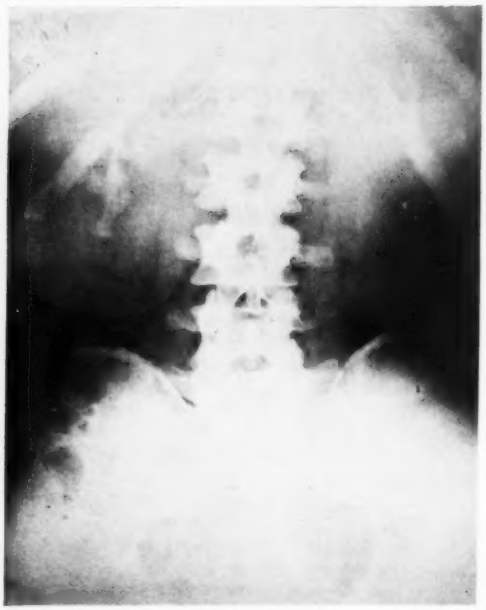


Fig. 1. Intravenous urogram (June 1949) made 180 minutes after administration of 20 c.c. of 35 per cent diodrast.

were greatly enlarged, but with relatively normal configuration. The radiographic findings superficially were compatible with a diagnosis of bilateral polycystic disease of the kidneys. Because of certain characteristics to be discussed later, however, it was felt that the picture might represent diffuse neoplastic (lymphosarcomatous) infiltration.

Except for pyuria and moderate anemia, the routine laboratory findings at this time were not remarkable. The blood non-protein nitrogen was found to be 170 mg. per cent. Treatment consisted in intravenous administration of fluids, and the patient was discharged on the fourth hospital day, moderately improved.

Nausea, vomiting, and abdominal pain continued, however, and the patient became severely cachectic. He complained of swelling of both feet and of pain in the knees, nocturia, and occasional burning on urination. His final admission to the hospital was on July 22, 1949. He was now chronically ill, with dyspnea upon ordinary movements. Blood pressure was 145/90, the pulse was 100, temperature 100° F., and the respiratory rate 22. The lung fields were clear. The heart was not enlarged to percussion, but a loud, harsh systolic murmur was heard in the aortic area and was transmitted to the neck. Palpation of the abdomen revealed a firm, slightly tender, nodular mass occupying most of the right upper quadrant. The mass did not move on respiration but could be moved laterally. A similar, smaller mass, which moved with respiration, occupied most of the left upper quadrant. There did not seem to be any free fluid in the abdomen. Marked pitting edema of the lower extremities was present, almost to the knees. Tendon reflexes and plantar reflexes were within normal limits. Laboratory examinations revealed severe anemia and pyuria. The blood non-protein nitrogen was 120 mg. per cent and the urea nitrogen 80 mg. per cent. The leukocyte count was 8,150, with 23 per cent lymphocytes and 76 per cent polymorphonuclears. No immature forms were noted. The specific gravity of the urine was 1.010; it contained a trace of albumin and numerous pus cells.

X-ray examination of the chest showed both lung fields to be clear. No mediastinal masses were apparent. The trachea was in the midline, and the right leaf of the diaphragm was elevated. The cardiac shadow approached the upper limits of normal.

During his hospital stay, the patient continued to vomit. In spite of transfusions of whole blood, his course was rapidly downhill and death ensued on Aug. 6, 1949.

Autopsy unfortunately was limited to an examination of the abdominal contents. Several small discrete lymph nodes were felt in the left axilla. A small amount of free fluid was found in the peritoneal cavity. The liver appeared to be slightly enlarged and showed several old scars. Its cut surface was normal in appearance. The stomach and intestinal tract were normal except for many shotty mesenteric lymph nodes. In the rectum were two ulcerated areas, the larger of which measured 1/2 × 1 1/2 inches. There were several areas of petechial hemorrhage in the mucosa of the bladder. The prostate was of normal appearance. Both kidneys were greatly enlarged, measuring 17.5 by 10 cm. They were pale but showed relatively normal markings (Fig. 2). The capsule stripped with moderate difficulty. The cut surface was pale and the markings were relatively normal except that the corticomedullary junction was indistinct. The adrenal glands were normal. There was no invasion of the retroperitoneal spaces and superficially the lumbar vertebrae appeared to be intact.

Histologic examination (Fig. 3) showed the renal parenchyma to be extensively replaced by cells of the lymphoid type having markedly hyperchromatic nuclei. There was considerable variation in the nuclear size and shape of these cells. Nucleoli were prominent and cytoplasm scanty. Most of the cells resembled typical lymphocytes; only a few scattered reticulum cells were found. Very few of the normal elements of the kidneys were present, most of the renal substance being replaced by lymphomatous tissue. Examination of the mesenteric nodes showed the cortical areas to be the seat of overgrowth of the lymph cells. The sinuses in the medullary portion were dilated and filled with young cells of the lymphoid and large mononuclear types. There was slight hypertrophy of the liver,

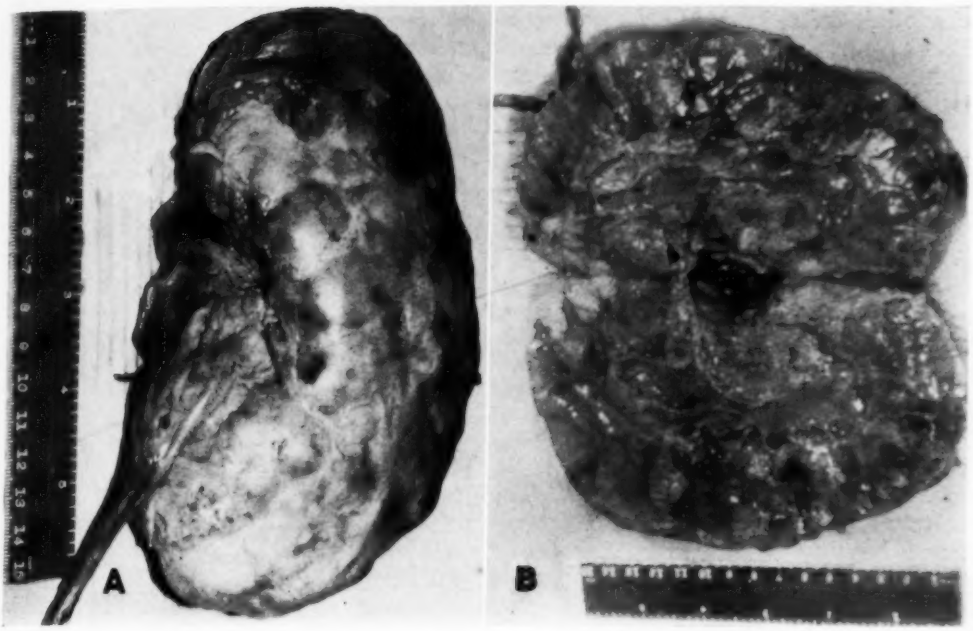


Fig. 2. Right kidney removed at autopsy. Notice nodularity of gross specimen (A) and the pale cortex on cut section (B).

but no lymphoid infiltration of the liver, the intestinal tract, or the spleen was found.

The diagnosis was reported by the pathologist as lymphosarcoma diffusely infiltrating both kidneys.

INCIDENCE AND PATHOLOGY

Lymphosarcomatous involvement of the kidney may occur either by metastasis or by direct invasion from adjacent foci. Many of the cases simulate primary renal neoplasms (Gibson, 1; Mathé, 3; Michael, 4; Price, 5). In a recent review of lymphosarcoma of the kidney, Gibson stated that there are four types of involvement of the kidney: (1) perirenal encompassment with or without secondary invasion, (2) nodular infiltration, (3) diffuse infiltration, and (4) large solitary tumor. He further reported that in 1940 Puente Duany reviewed the world's literature and found only 17 cases of diffuse bilateral renal infiltration. A review of the available literature revealed no other cases reported in English, although Gibson stated that an eighteenth case had been described by Panisello, Gispert, and Ma-

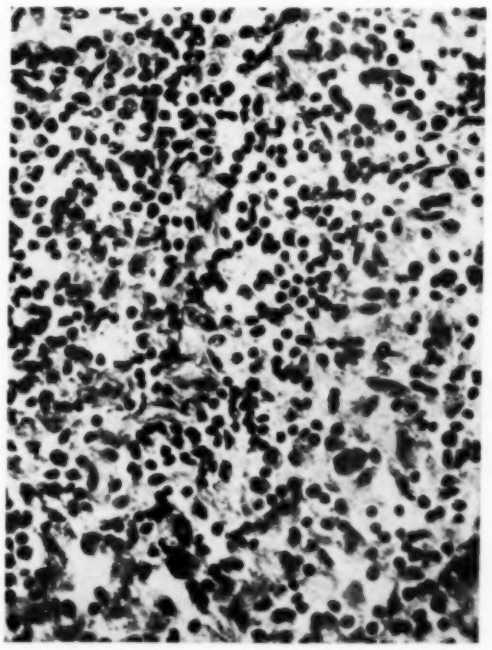


Fig. 3. Microscopic section from right kidney, showing extensive replacement of renal parenchyma by cells of lymphoid type.

chado of Cuba in 1944. According to Puente Duany, quoted by Gibson, bilateral diffuse lymphosarcomatosis of the kidney is most common in infancy and in males. His description of histologic changes corresponded closely to the findings in the present case. The blood does not show leukemic changes. The kidneys may increase to four or five times their normal size.

ROENTGEN FINDINGS

The intravenous urogram made on the June 1949 admission (Fig. 1) showed delayed excretion of contrast medium in poor quantity. The renal shadows were symmetrically enlarged to a size of 21 × 13 cm. but were of normal shape. The calyces and infundibula were greatly elongated and slightly enlarged. There was a thick renal cortical shadow averaging 5.8 cm. No calcification was visible. The psoas shadows were sharp and well preserved. On first inspection, this picture closely resembled polycystic disease. Further observation, however, revealed no real calyceal deformities, filling defects, displacements, or irregularities.

The roentgen findings described above were essentially the same as reported by Gowdey and Neuhauser (2) in diffuse leukemic infiltration in children, but with one difference. In Gowdey and Neuhauser's cases, excretion of the dye was in good concentration, while in the present case the dye was excreted in poor concentration. It may be, however, that this merely represents a late finding in our patient.

In the roentgen study of the kidney, diffuse lymphosarcomatous infiltration is likely to be confused with polycystic disease, but the characteristic multiple rounded filling defects that deform the pelves, infundibula, and calyces of polycystic kidneys are absent. In both conditions diodrast excretion is decreased late in the course of the disease. It is felt that the lack of calyceal deformities, filling defects, displacements, or irregularities is of sufficient significance to enable one to differentiate bilateral diffuse lymphosarcomatosis of the kidney from polycystic disease.

SUMMARY

Diffuse bilateral lymphosarcomatous infiltration of the kidney is a rare form of metastatic involvement. Eighteen previous cases have been recorded. A further case is reported here.

A roentgen picture which seems characteristic is described. This includes delayed excretion of contrast material in poor concentration, symmetrical enlargement of the renal shadows with preservation of the normal shape, enlargement of the renal pelves without dilatation, and elongation of the calyces and infundibula without deformity, filling defects, or irregularity of outline.

This picture resembles that of leukemic renal infiltration in children and polycystic disease of the kidneys. In leukemic infiltration, however, the excretion of the dye is described as prompt and in good concentration. Polycystic disease is characterized by calyceal deformities, filling defects, displacements, and irregularities.

Wichita General Hospital
Wichita Falls, Texas

REFERENCES

1. GIBSON, T. E.: Lymphosarcoma of the Kidney. J. Urol. **60:** 838–854, December 1948.
2. GOWDEY, J. F., AND NEUHAUSER, E. B. D.: Roentgen Diagnosis of Diffuse Leukemic Infiltration of the Kidneys in Children. Am. J. Roentgenol. **60:** 13–21, July 1948.
3. MATHÉ, C. P.: Retroperitoneal Lymphoblastoma Simulating Kidney Neoplasm. Report of Case. J. Urol. **17:** 357–366, March 1927.
4. MICHAEL, P.: Lymphosarcoma of the Kidney. Urol. & Cutan. Rev. **44:** 751–753, December 1940.
5. PRICE, H. L.: Case Report. Lymphosarcoma of the Kidney. Ohio State M. J. **25:** 550–552, July 1929.
6. TURNER: Trans. P. S. London **29:** 342, 1878. Reprint.

SUMARIO

Linfosarcoma Renal. Historia Clínica y Descripción de los Hallazgos Roentgenológicos

La infiltración linfosarcomatosa bilateral difusa del riñón constituye una rara forma de metástasis, no habiéndose comunicado más que 18 casos hasta ahora. A ellos se agrega el caso aquí descrito.

El cuadro roentgenológico presentado parece típico, comprendiendo: demora en la excreción y mala concentración de la sustancia de contraste, agrandamiento simétrico de las imágenes renales con conservación de la forma normal, hipertrofia sin dilatación de las pelvis renales y alargamiento de los cálices e infundíbulos sin deformidad, nichos o irregularidad de los contornos.

Dicho cuadro semeja el de la infiltración renal leucémica en los niños y el de la enfermedad poliquística de los riñones; sin embargo, en la infiltración leucémica, la excreción del colorante aparece descrita como rápida y bien concentrada. A su vez, la enfermedad poliquística caracterízase por deformidades de los cálices, nichos, desplazamientos e irregularidades.

Bilateral Fracture of the Humeral Heads

Case with Fractures of the Anatomical and Surgical Necks of the Humeri due to Convulsion[1]

GULDEN MACKMULL, M.D., and S. DANA WEEDER, M. D.

BILATERAL FRACTURE of the heads of both humeri due to muscular action is a rare phenomenon. The following is a case report presenting several unusual features.

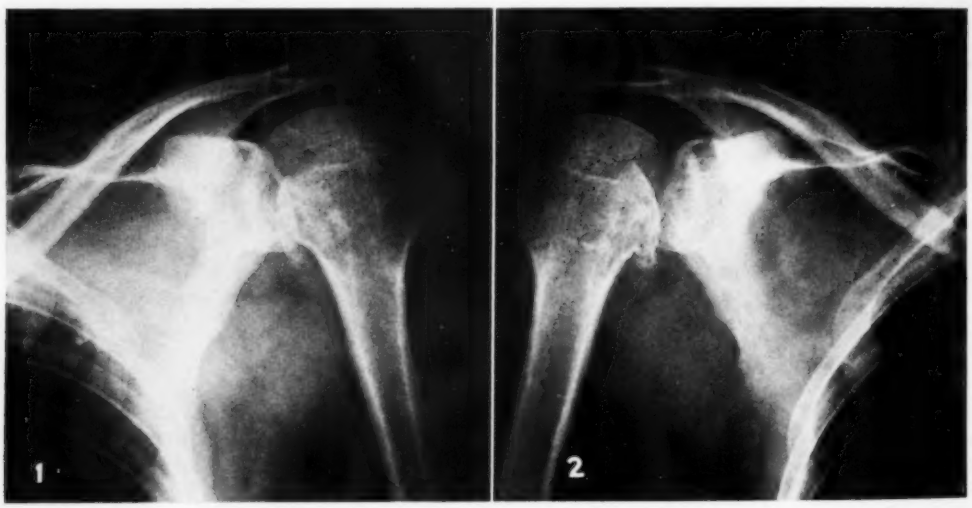
CASE REPORT

A 53-year-old white man was known to have had hypertension for six years. Except for occasional headaches and continued apprehension concerning his blood pressure, he was in good health.

On the afternoon of the episode related here, the patient was host at a small cocktail party in his home. His behavior was perfectly conventional and at no time did he either feel or display evidence of intoxication. Following the departure of his guests, his words became jumbled and incomprehensible, although no facial paralysis or other motor weakness was observed. Several minutes after being escorted to bed, he suffered a nose bleed, accompanied by deep, snoring respirations. The eyes rolled back in the head, the back became arched, and the arms were flung violently back and forth. At no time did the flaying arms strike either the side of the bed or at any object. The convulsion lasted an estimated thirty seconds.

When the attending physician arrived, the patient had regained consciousness; speech was incoherent, and he was weeping hysterically. While walking with support to the bathroom, he held his arms tightly against his chest, as though in violent pain. Blood pressure at this time was 260/140, pulse 100 and regular; the reflexes were equal but hyperactive.

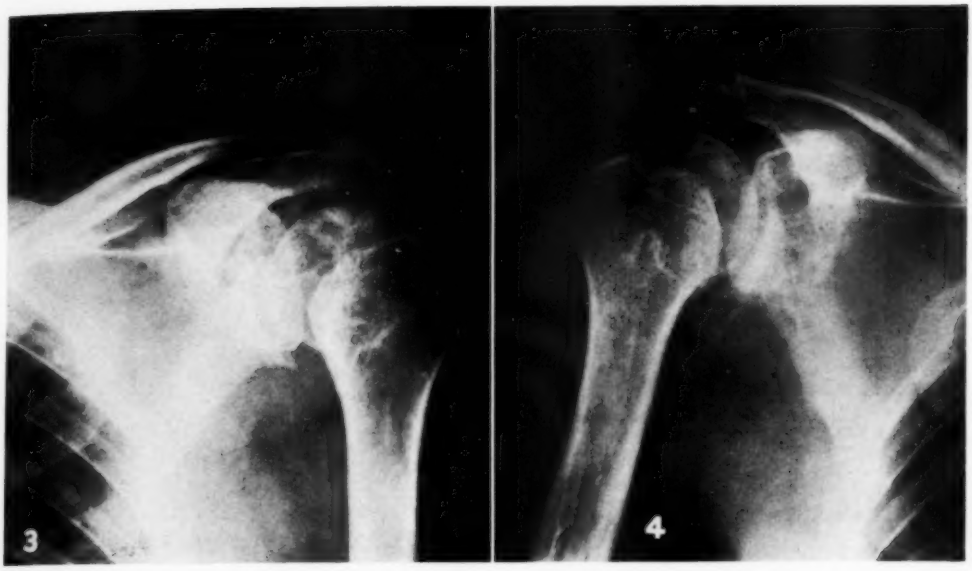
On arrival at the hospital, the patient said that he felt fairly well but complained of severe pains in both shoulders. The slightest motion of either arms or shoulder joints was painful, although forearms, hands, and legs could be moved normally. Roentgenograms were taken, with the following findings:



Figs. 1 and 2. Roentgenograms taken one day after the convulsion. Fig. 1. Left arm. Fig. 2. Right arm. In each instance the posterior fragment is dislocated behind the glenoid cavity.

The *left arm* (Fig. 1) showed a shearing fracture of the posteromedial margin of the articular surface of the head of the humerus. A 5-cm. portion of the humeral head which articulated with the glenoid cavity was displaced caudally about 1.5 cm. This displaced fragment was so situated that the inferior margin lay beneath the inferior rim of the glenoid cavity. The greater tubercle was partially detached

[1] From the Medical and Surgical Departments of the Germantown Dispensary and Hospital, Philadelphia, Penna. Accepted for publication in March 1950.



Figs. 3 and 4. Roentgenograms taken approximately one year after the convulsion. Fig. 3. Left arm. Fig. 4. Right arm. In each instance the posterior dislocated fragment is forming a ledge of bone as part of the new articulating surface.

and displaced caudally. There was also a transverse fracture of the surgical neck, without displacement or deformity. The larger fragment appeared posterior to the glenoid fossa.

The *right arm* (Fig. 2) showed a similar fracture of the articular surface of the head of the humerus, except that the larger fragment of the head, while being detached, was not displaced to the same degree as that of the other arm. This fragment appeared to be impacted. The larger fragment in this arm was also displaced posterior to the glenoid cavity.

Each arm showed a longitudinal fracture of the head of the humerus in the coronal axis. No roentgen evidence of disease of the cranium, chest, pelvis and upper ends of the femora was observed (1).

Results of laboratory tests were as follows: complete blood count, normal; urine, normal; blood urea nitrogen 23 mg.; serum inorganic phosphate 3.1 mg.; acid phosphatase 1.7 units (Bodansky); alkaline phosphatase 2.1 units; serum calcium 10.5 mg.

Physical and neurological examinations were negative except for the fractures described above. The eye-grounds showed Grade II sclerosis.

Surgical correction consisted of supporting the arms in a halter-sling.

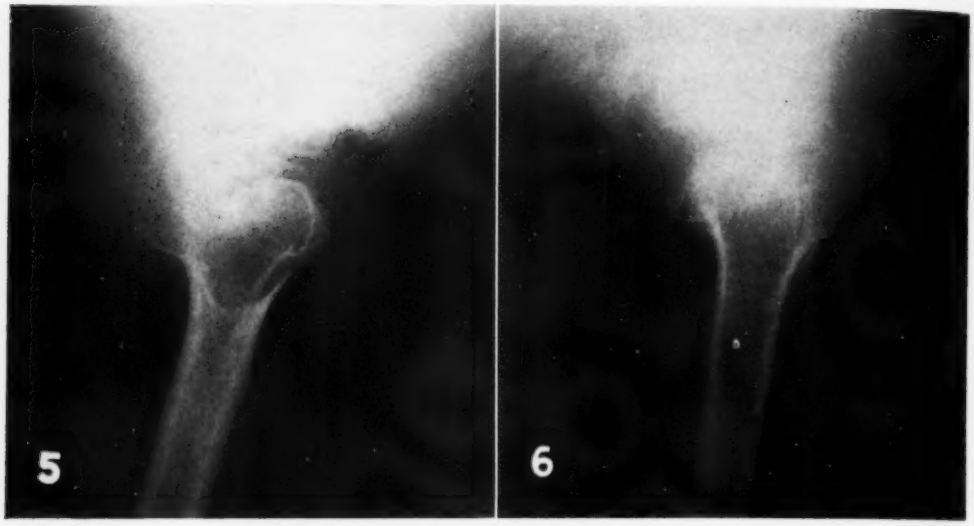
For about four days following the convulsion, the patient appeared confused, and his speech was halting and slurred. On the fifth day, he became mentally clear and expressed surprise at being in the hospital, claiming that he did not remember anything that had transpired during the party or since.

Six weeks after the convulsion some motion had been recovered in both arms. Pain had diminished. Roentgenograms obtained at this time showed satisfactory healing of the upper ends of the humeri with persistent deformity and posterior dislocation of the larger fragments of the heads. Six months after the episode described, the patient was able to place his hands on top of his head and elevate the arms practically at right angles to the body.

One year later, motion of both arms was within 10 degrees of the upright. Roentgenograms at this time (Figs. 3 and 4) showed the humeral heads to be forked, with the posterior lobulation dislocated behind the glenoid cavity. In this new location, a ledge of bone had formed producing the effect of a false joint.

DISCUSSION

While fractures of various bones are not infrequently the result of induced convulsions, fractures of the humerus, particularly of the anatomic neck, under similar conditions are very rare. Of 628 patients receiving 8,082 electroshock convulsions, 11 sustained fractures. Involvement of the humerus was not reported by Kaldeck and associates (2). In a series of 230 patients subjected to electroshock, despite a total of 770 fractures, chiefly vertebral, no instance



Figs. 5 and 6. Vertical views of the left (Fig. 5) and right (Fig. 6) arms, about one year after the convulsion.

of humeral fracture was found by Lingley and Robbins (3).

Pollosson (4), in 1888, reported the autopsy findings on a 30-year-old woman who, during an eclamptic convulsion, tore the cartilaginous border immediately below the lesser tuberosity of both humeri. Ravanier and Laquerrière, in 1922 (5), published an account of vertical fractures of the superior extremity of both humeri as a result of a convulsive seizure in a 45-year-old man. Unilateral fractures of the humerus below the surgical neck resulting from muscular action were detailed by Lebeuif in 1887 (6).

Traumatic fractures of a similar nature are also unusual. Snodgrass (7) reported fracture of the anatomic neck of each humerus resulting from a fall. Beck (8) published a report of a similar fracture of one humerus. Funsten (9) collected 27 cases of fracture of the neck of the humerus resulting from trauma; none were bilateral.

The associated posterior (retroglenoid) dislocation of the humerus is an uncommon finding on roentgen examination. In 6,000 studies of the shoulder, only 4 such cases were found by Thomas (10).

Posterior dislocation of the shoulder either as a result of trauma or convulsive seizures, especially epilepsy, was reported by Astley Cooper in 1838 (11) and by Malagaigne in 1855 (12). Only since the advent of x-ray examinations, however, have the attending dislocations received adequate attention. Even now such dislocations are frequently overlooked in the absence of awareness of dislocation or special views of the offending shoulder. Both anteroposterior and lateral films are suggested. Lateral views can be obtained by placing the film over the top of the shoulder with the humerus moderately abducted and the ray directed into the axilla (Wilson and McKeever, 13).

Stereoscopic anteroposterior views are basic for the proper diagnosis of posterior dislocation of the humerus (Figs. 3 and 4) By this method the following characteristic x-ray pattern will be obtained: (1) The lesser tuberosity is rotated and brought into extreme profile medially at the posterior lip of the glenoid fossa. (2) The greater tuberosity is not as medial as the lesser tuberosity, and their shadows overlap. (3) The head of the humerus is directly posterior and medial to the glenoid fossa and widely separated from the coracoid process. In contrast, the normal humeral head is directly lateral, with the

greater tuberosity overshadowing the lesser tuberosity and actually presented as the medial profile. (4) The lower third of the glenoid fossa is exposed, due to the displaced head (Rendich and Poppel, 14).

The case presented here is one of bilateral fracture of the surgical and anatomic necks of each humerus, resulting from a convulsion apparently motivated by a cerebral vascular accident. The responsible cranial lesion was probably either a small thrombosis or a spasm of a branch of the left middle cerebral artery, involving particularly the area of expressive speech. Since this area lies immediately adjacent to the motor cortex, a stimulus which leads to the seizure probably spreads to produce a generalized convulsion (Alpers, 15).

The mechanical forces responsible for bilateral fractures of the heads of the humeri are difficult to analyze because of the varied and bizarre positions assumed by the arms during a convulsion (Bennett, 16). The common mode of action is pressure backward and outward on the head of the humerus, either directly or through the elbow, combined with adduction of the arms across the front of the chest (Rendich and Poppel, 14; Snodgrass, 7; Dehne, 17).

In the case presented here, muscular action has been established definitely as the only possible cause of the fractures, since the patient was under continuous observation from the time of the convulsion.

SUMMARY

A generalized convulsion produced bilateral fractures of the anatomical and surgical necks of the humeri with posterior displacement of the posterior fragments. The possible causes are discussed and the literature is reviewed.

100 W. Coulter St.
Philadelphia 44, Penna.

REFERENCES

1. YOUNG, B. R.: Personal communication.
2. KALDECK, R., MCLAUGHLIN, W. F., GURRI, J., AND WASSERSUG, J. I.: Physical Risks of Electroconvulsive Therapy. New England J. Med. **239:** 773–779, Nov. 18, 1948.
3. LINGLEY, J. R., AND ROBBINS, L. L.: Fractures Following Electroshock Therapy. Radiology **48:** 124–128, February 1947.
4. POLLOSSON, A.: Fractures par enfoncement des deux têtes humérales, dues à des convulsions musculaires chez une éclamptique. Rev. de chir. **8:** 927–929, 1888.
5. RAVANIER, AND LAQUERRIÈRE, A.: Fractures verticales des deux humerus a leur extrémité supérieure. J. de radiol et d'électrol. **6:** 283–284, June 1922.
6. LEBEUIF, L. G.: Double Fracture of the Humerus Caused by Muscular Action. New Orleans M. & S. J. **15:** 624–625, 1887.
7. SNODGRASS, L. E.: Bilateral Fracture of the Anatomical Neck of the Humerus. Case Report. Am. J. Roentgenol. **36:** 310–311, September 1936.
8. BECK, C.: On the Treatment of Fractures of the Anatomical Neck of the Humerus by the Aid of the Roentgen Rays. New York M. J. **75:** 573, April 5, 1902.
9. FUNSTEN, R. V., AND KINSER, P.: Fractures and Dislocations about the Shoulder. J. Bone & Joint Surg. **18:** 191–198, January 1936.
10. THOMAS, M. A.: Posterior Subacromial Dislocation of the Head of the Humerus. Am. J. Roentgenol. **37:** 767–773, June 1937.
11. COOPER, A.: On the Dislocation of the Os Humeri upon the Dorsum Scapulae and upon Fractures near the Shoulder Joint. Guy's Hosp. Rep. **4:** 265–284, 1839.
12. MALAGAIGNE, J. F.: Traite des fractures et des luxations. Paris, J. B. Baillière, 1855.
13. WILSON, J. C., AND MCKEEVER, F. M.: Traumatic Posterior (Retroglenoid) Dislocation of the Humerus. J. Bone & Joint Surg. **31-A:** 160–172, January 1949.
14. RENDICH, R. A., AND POPPEL, M. H.: Roentgen Diagnosis of Posterior Dislocation of the Shoulder. Radiology **36:** 42–45, January 1941.
15. ALPERS, B. J.: Personal communication.
16. BENNETT, G. B.: Personal communication.
17. DEHNE, E.: Fractures at the Upper End of the Humerus: A Classification Based on the Etiology of the Trauma. S. Clin. North America **25:** 28–47, February 1945.

SUMARIO

Fractura Bilateral de las Cabezas Humerales. Caso con Fracturas de los Cuellos Anatómicos y Quirúrgicos de los Húmeros, Debido a Convulsión

El caso comunicado es de fracturas de los cuellos anatómicos y quirúrgicos de ambos húmeros debidas a una convulsión general, con dislocación retroglenoidea de los fragmentos posteriores. Las radiografías tomadas al año de ocurrir las fracturas revelaron que las cabezas de los húmeros estaban bifurcadas, hallándose la porción posterior luxada detrás de la fosa glenoidea, donde se había formado un reborde de hueso, produciendo el efecto de una falsa articulación.

Priodax and Pseudoalbuminuria

E. E. SEEDORF, M.D., W. N. POWELL, M.D., R. G. GREENLEE, M.D. and J. T. HARTMAN, M.D.

Temple, Texas

PRIODAX, WHICH became available in the United States in 1942, is the most recent drug for cholecystography. This iodine-containing preparation with the chemical name, beta-(4-hydroxy-3,5-diiodophenyl)-alpha-phenyl-propionic acid, is similar to the German drug "Biliselectan" synthesized by Dohrn and Diedrich in 1940 (1). Numerous articles have been written concerning its advantages as well as its undesirable effects. Wide clinical use during the past few years has demonstrated its safety and, although there is considerable variance in the subjective reactions reported, most writers agree that priodax is better tolerated and has definite advantages over tetraiodophenolphthalein.

Unlike tetraiodophenolphthalein, which is excreted by the colon, priodax is mainly eliminated by the kidneys. Junkmann (2), working with rats and rabbits, demonstrated that, after the dye had been administered orally, 50 per cent was excreted in the urine within twenty-four hours and 61 to 83 per cent within seventy-two hours. Modell (3) reported a transient albuminuria, lasting from one to seven days, in a majority of cats given large single oral doses of priodax. Since even with large doses no histologic evidence of renal damage was demonstrable, he concluded that it was most certainly a "safe drug" and non-toxic when used in the small amounts necessary for cholecystography. Howard (4) demonstrated that the preparation had no injurious effect on the pancreas.

Recently it was observed at the Scott and White Clinic that the incidence of "albuminuria" was higher among patients who were given priodax for gallbladder examinations than among others. In order to verify this observation, the urine of 100 consecutive patients was examined on the day on which cholecystography was done along with that of an equal number of control patients. Evidence of "albumin" in the urine was obtained in 36 per cent of those receiving priodax and in only 5 per cent of the control group. Although only a "trace" of albumin was found in most instances, grade I or even grade II albuminuria was occasionally reported.

The foregoing observations prompted a more thorough investigation. A second series of patients receiving priodax was followed until 100 urine specimens containing "albumin" were recorded. In this series the urine of each patient was examined the day prior to cholecystography, the day of the examination, and the day following. Whenever "albumin" was reported, subsequent urine specimens were analyzed on successive days until a negative report was obtained. Those patients having a true albuminuria prior to taking priodax were, of course, excluded from the series, as were women who were menstruating at the time of the examination.

The clinical laboratory of our institution gave this series of urine specimens special attention, analyzing many of them from a qualitative standpoint to discover the exact nature of the "albumin" and to determine whether it represented a false positive reaction due to the presence of priodax or a true albuminuria, presumably from an irritant effect of the drug on the kidneys.

Upon applying any of the routine procedures used to detect albumin, it was noted that an immediate cloudiness or precipitation occurred in the urine specimens tested. Exton's reagent[2] is used most often in our laboratory, but similar reactions were ob-

[1] From the Department of Radiology (Dr. Seedorf; Dr. Hartman, Resident in Radiology), the Department of Clinical Pathology (Dr. Powell), and the Department of Medicine (Dr. Greenlee) of the Scott and White Clinic, Temple, Texas. Accepted for publication in February 1950.

[2] Sodium sulfate plus sulfosalicylic acid.

served with the Heller ring test[3] and with Robert's reagent.[4]

As an aid in our studies, the Schering Corporation kindly made available a generous quantity of pure priodax, free from any binding substances. Information afforded us by the Schering Corporation and subsequent experimentation showed this to be soluble in an alkaline medium and to be readily precipitated by acidification of the solution. Comparison tests showed that the pure priodax solutions, when examined with Exton's or Robert's reagent or by the Heller ring test, behaved in a manner identical to the urine specimens being analyzed. This was accepted as conclusive evidence that the priodax in the urine could be the cause of a false positive test for albumin.

Further investigation revealed that the precipitate in an acidified solution of priodax and in the urine samples redissolves rapidly when the medium is made alkaline. The solution, as a consequence, again becomes clear. An albumin precipitate does not redissolve in this manner and the medium remains cloudy.

Boiling the acidified urine samples or the priodax preparation also resulted in definite clearing. In the presence of albumin, on the other hand, not only is there no clearing but there may even be an increase in cloudiness of the heated medium. Incidentally, it may be mentioned here that, should both priodax and albumin be present in the same solution, they may be detected and separated by this procedure. A large part of the priodax fraction will redissolve as the solution is boiled and, upon filtering, will pass off in the filtrate, the albumin remaining behind. The priodax may then again be precipitated out of the filtrate.

A further differentiation of a true albumin precipitate from the "false albumin," or priodax, is made by observing the rather homogeneous appearance of the latter as compared with the more flocculent appearance of the true albumin. This point is of little actual importance, however, as one seldom needs to make so fine a distinction.

In this study, a number of additional observations were made. Among these was the fact that of the 100 urine specimens positive on the morning of cholecystography, 10 were again positive the following day. In 3 of these 10 sufficient amounts of priodax were still present on the third day to yield a positive reaction. Thus a false albuminuria may occur not only on the day of the gallbladder examination but for several days thereafter. It would seem important that this possibility be kept in mind.

Initial observations led us to believe that the incidence of false albuminuria was somewhat greater in females than in males. This was later substantiated, but the ratio of women to men was found to be only 1.5:1. Our figures revealed also that the younger age group (twenty to thirty years) showed the highest percentage of false albuminuria, with a slight but continuous decrease with advancing years. Of greater significance is the fact that a higher incidence of false albuminuria occurred in the lightest weight group. With all patients receiving six priodax tablets orally, there was a steady and proportionate decrease in incidence as the weight increased. Younger individuals weigh less, as a rule, than older persons; and women weigh less, on the average, than men. Therefore, the more frequent occurrence of false albuminuria in younger age groups and females can be explained, at least in part, by the fact that the standard dosage of six tablets will produce a greater concentration of priodax in the urine in the lower-weight groups. In other words, the incidence of false albuminuria is directly proportional to the concentration of priodax, which in turn varies in an indirect or inverse proportion to the weight of the patient.

Forty-five per cent of the patients taking priodax complained of a slight burning on urination. There was no apparent correla-

[3] Pure nitric acid.
[4] Five parts saturated solution of magnesium sulfate plus one part pure nitric acid.

tion to be made, however, between the incidence of dysuria and the presence of false albuminuria. Furthermore, the presence or absence of pathologic findings on the cholecystogram bore no relation to the incidence of false albuminuria.

The question of whether changing temperature and barometric readings might influence the incidence of false albuminuria was also considered. It was theorized that during colder seasons, when the fluid intake is less, a greater concentration of priodax might occur in the urine. Our figures, however, failed to substantiate any significant association between weather conditions and incidence of priodax in the urine. Nor was any correlation demonstrable between the specific gravity of the urine and the occurrence or amount of priodax in the urine. Finally, there was no significant difference in the microscopic picture of the urine of patients receiving priodax and that of negative routine urine specimens.

SUMMARY AND CONCLUSIONS

A false positive reaction for albumin will occur in the analysis of the urine of a significant number of patients receiving the standard dosage of six tablets of priodax. The fact that it is the actual presence of priodax in the urine which causes this reaction is proved by laboratory tests.

The false albuminuria occurs with the greatest frequency in the lighter weight group and, therefore, in women and younger individuals. Other factors, such as prevailing barometric and temperature readings and the specific gravity of the urine examined, play no apparent role.

Detectable amounts of priodax are present in the urine of certain patients not only on the morning after the ingestion of priodax, but the following day and occasionally even on the third day.

A report of albuminuria in patients who have received priodax should therefore be interpreted with caution as far as the presence or absence of renal disease is concerned. To avoid confusion or misinterpretation, the urine of gallbladder patients should be examined prior to the administration of priodax. If this is not possible or practical, it would seem advisable that for three days following ingestion of priodax some notation to the effect that priodax has been administered be made on urine request slips.

"Albuminuria" occurring after administration of six tablets of priodax does not indicate renal irritation due to the drug.

Scott & White Clinic
Temple, Texas

REFERENCES

1. DOHRN, M., AND DIEDRICH, P.: Ein neues Röntgenkontrastmittel der Gallenblase. Deutsche med. Wchnschr. **66:** 1133–1134, Oct. 11, 1940.
2. JUNKMANN, K.: Perorale Cholecystographie mit Biliselectan. Klin. Wchnschr. **20:** 125–128, Feb. 1, 1941.
3. MODELL, W.: The Pharmacology of Beta (3,5 Di-iodo-4-Hydroxyphenyl) Alpha Phenyl Propionic Acid. J. Lab. & Clin. Med. **27:** 1376–1384, August 1942.
4. HOWARD, J.: Experimental Studies on the Toxicity of Beta (4-Hydroxy-3,5-Diiodophenyl) Alpha-Phenyl-Propionic Acid (Priodax). Am. J. Roentgenol. **59:** 408–415, March 1948.

SUMARIO

Priodax y Seudoalbuminuria

Al analizar la orina de un número significativo de enfermos que reciben la dosis corriente de seis tabletas de priodax para la colecistografía, se obtendrá una reacción seudopositiva para albúmina. Pruebas de laboratorio demuestran que es la presencia del priodax mismo en la orina lo que ocasiona dicha reacción, la cual no constituye indicación de irritación renal debida a la droga.

La falsa albuminuria consecutiva a la administración de priodax alcanza su mayor frecuencia en el grupo de peso más liviano y, por lo tanto, en las mujeres y personas más jóvenes.

En ciertos enfermos, hay presentes en la orina cantidades apreciables de priodax, no sólo en la mañana consecutiva a la ingestión de la droga, sino también el día siguiente y a veces hasta el tercer día.

Dosage Units for High-Energy Radiation[1]

U. FANO and LAURISTON S. TAYLOR

THE STUDY OF radiation dosage measurement began twenty-five years ago with the main problem of establishing a system of x-ray dosage. It has been extended in recent years to many other types of radiation.

It is important for us today to appreciate the fact that originally the establishment of a unit and method of x-ray dosage was thought to be, or rather hoped to be, a relatively simple and straightforward problem. In the early 20's, x-rays were gaining recognition as a therapeutic agent. It was realized that as an x-ray beam passed through the body it was partially absorbed and it was therefore thought desirable to measure a *property of this radiation* which was *related to its absorption in tissue*.

It was also recognized that the process of ionization of gases formed a convenient method for measurement. Consequently, the ionization measured in a gas whose effective atomic properties were closely similar to those of tissue was expected to bear a relationship to the ionization produced in tissue. Air meets this fundamental requirement closely and constitutes a readily available, fairly highly insulating medium. It was therefore chosen as a standard medium. The first specific proposal for employing air ionization measurements as a means of x-ray dosage measurement was made in 1918 by Sczillard. From then up to 1928, a considerable number of investigators studied the application of air ionization measurements to x-ray dosage.

Some of the earliest studies in this connection led to the development of thimble ionization chambers made of horn, with the idea that these could be inserted into the body or used in phantoms for exploring the distribution of radiation administered in broad beams to the body. The construction of the first thimble chambers was beset with many difficulties, and it appeared to be virtually impossible to make two alike in an absolute sense. It was not until the work of Fricke and Glasser that we had a reasonably clear understanding of the mechanism involved in these chambers. It took still longer to realize that there were numerous serious problems in the way of using them as standards.

In the meantime, a proposal had been made that x-ray dosage be expressed in terms of the ionization produced in a definite volume of air. The great difficulty with the thimble chamber was that its walls both added and detracted from the ionization produced within it, and the absolute magnitude of these effects was not easily definable or reproducible. As a consequence, the unit of x-ray dosage came to be defined in terms of the ionization produced in a definite volume of air *unrestricted* by any wall material which would influence the ionization within the specified volume.

The physical achievement of such a measurement was accomplished by means of what we now think of as "open-air" ionization chambers. The fact that such apparatus could be constructed was demonstrated for the voltages then in use, which did not exceed 200 kv. p. The first definition of x-ray dosage was tentatively accepted on an international basis in 1928 by the Second International Congress of Radiology. Essentially, the unit, called the "roentgen," was defined in terms of the ionization produced in a cubic centimeter of air under normal conditions, with the avoidance of wall effects.

It is interesting and not entirely illogical

---

[1] From the Radiation Physics Laboratory, National Bureau of Standards, Washington, D. C. Substance of a paper delivered by Lauriston S. Taylor on July 25, 1950, by invitation, at the Symposium on Units of the Sixth International Congress of Radiology in London. Presented also at the Thirty-fifth Annual Meeting of the Radiological Society of North America, Cleveland, Ohio, Dec. 4–9, 1949.

that this early definition was to a considerable extent built around the apparatus for its measurement. As later events proved, however, this has led to an awkward situation, because, as our exciting energies increased, we were placed in a position of having *continually to modify* the definition of the roentgen in order to cope with the new properties of the higher-energy radiations.

Because of this situation, minor modifications in the definition of the roentgen were made in 1931, 1934 and 1937, it being believed at the last date that we had reached the ultimate in energies, then in the neighborhood of a million volts. Matters soon took a different turn, however. In fact, as we progress into the multimillion-volt energy region, practical difficulties stand increasingly in the way of carrying out measurements in conformity with the 1937 definition of the roentgen. But the crucial point is that the process considered by this definition is *no longer representative* of the basic situation which we wish to measure and study.

The definition states that the roentgen is a quantity of x or gamma radiation specified by the amount of "associated corpuscular emission"—meaning electrons —which the radiation generates at a point under consideration. The amount of associated corpuscular emission itself is specified, in turn, by the ionization which it produces, *no matter where this production takes place.*

In the low- or medium-energy range the electrons do not travel far from the point where they are emitted. Therefore, the measurement of ionization at any point in air reflects in practice, if not in principle, the emission of electrons and the quantity of x-rays *at that very point.* At higher energies the electrons travel a substantial distance. The ionization produced at any point *no longer represents,* even in practice, the emission of electrons or the flow of x-rays at that point. This is a *basic failure* of the principle on which the concept of the roentgen unit is based.

Let us try to indicate the actual seriousness of this situation in any one case. It takes only a little consideration to see that the concept of the roentgen remains useful as long as the penetration of the x-rays is *much larger* than the penetration of their associated electrons. Here are some figures for various energies:

Energy (mev)	0.5	5	50
Mean penetration (meters of air)			
X-rays	100	300	500
Electrons	1	20	170

The point we are stressing is briefly this: the flow of high-energy x or gamma rays at any one point is no longer related clearly and directly to the ionization produced or the energy dissipated at that point. There is nothing to be done about this fact, except to recognize it and to set our course accordingly.

Under the conditions, we must go back to fundamentals and examine what we are really trying to accomplish with our dosimetry. We see at once that dosimetry has actually not one but two rather distinct purposes. If one wants to evaluate the performance of an x-ray machine, he will be talking about the *flow* of x-rays. If one wants to discuss the effect of x-rays on a patient, he will be talking about the ionization produced or the *energy dissipated* within the body.

The problem of studying the flow of high-energy x-rays is of greater interest to the physicist and the x-ray engineer than to the radiologist. We shall not consider this problem further except for noting that much progress has recently been made toward its solution, especially by the California synchrotron group.

Now, if we abandon the attempt to indicate by a single number the flow of x-rays at a point and the energy dissipated at the same point, we reap at once a compensatory advantage. As soon as we start considering the production of ionization or the dissipation of energy *per se,* independently of the flow of x-rays, it matters little whether the energy dissipation stems originally from x-rays or from any other ionizing radiation. This is to say that it

becomes possible to adopt *a common basis of dosimetry* for all ionizing radiations: x-rays, beta rays, alpha rays, neutrons, etc. Such a common dosimetry has been sought for a long time but never yet achieved.

Thus far, we have frequently mentioned in the same breath the "ionization produced" and the "energy dissipated" in a material. Which of these quantities do we really consider most important? Which of them do we want to take as a basis for dosimetry? This is a somewhat delicate question. There is little doubt as to the *facts* pertinent to this question. Its solution involves rather a judgment of *policy*.

The amount of energy dissipated by an ionizing radiation in each portion of a material surely represents the most obvious and physically sound term of reference for discussing the effects produced by the radiation in that material. Therefore, *in principle*, the energy dissipation, expressed, for example, in ergs per gram of material, affords a natural basis for dosimetry. However, *in practice*, the direct measurement of energy dissipation is neither convenient nor accurate.

On the other hand, the ionization produced in the air of a cavity within a material can be measured with ease, convenience, accuracy, and high sensitivity. The magnitude of this ionization relates fairly closely to the energy dissipated in the material, but this is just about all that can be said for it with confidence. It need not be very significant in any other connection.

Today, the most convenient path for determining the energy dissipation in a material seems to be an indirect one, through the measurement of cavity ionization. If we trusted that this method would remain the most convenient one in the future, we would perhaps recommend that the cavity ionization itself be regarded as the primary term of reference for dosimetry. Experience, however, has shown the wisdom of leaving the door open to future developments of technic. We want to minimize the danger of having again and again to revise our basis of dosimetry. It seems reasonable, therefore, to adopt the solution which is soundest *in principle*, and to leave it to the ingenuity of laboratory workers to make this solution work acceptably in practice.

A majority of interested workers appear to favor the adoption of energy dissipation as the ultimate basis of dosimetry and to temper this solution by explicitly recognizing cavity ionization as an intermediate term of reference. In this way, each individual worker would be encouraged to report the results of his ionization measurements directly in units of ionization. The reduction of such data into energy units would be presented separately. The present inaccuracy in the knowledge of the reduction constants would weigh down the accuracy of the final result expressed in energy units, but a record of the more accurate ionization measurements would remain available.

In considering what recommendations should be introduced at this Congress, there arose a new question which, though really only incidental, calls again for some choice of policy. In what units should one express the results of dosage determinations? Should one use standard physical units wherever possible, or should one introduce some special practical units?

At the outset, there was a feeling that a majority of radiological physicists would strongly prefer the adoption of units whose magnitude matches the x-ray roentgen, at least approximately. Therefore, units were chosen tentatively in such a way that water or soft tissue exposed to one roentgen of medium hard x-rays also receives very approximately one unit of energy dose and induces one unit of ionization in the air contained in an infinitesimal cavity. We are personally prepared to go along with this procedure. Nevertheless, we feel that it would probably prove wiser in the long run to express all results in standard physical units, such as ergs per gram or electrostatic units of ionization per gram, as the case may be.

It has been rather interesting to see how this problem of introducing basic physical

units was received by the radiologists. The physicists have felt for many years that if such basic units could be once introduced, the long-range problems of dosimetry would undoubtedly be simplified. However, there was the fear that the radiologists, who had just become really familiar with the roentgen, would resent the introduction of new units, however great their necessity. It was felt that some compromise must be made so that the radiologist would not be too seriously disturbed in his thinking in terms of roentgens. We were therefore pleasantly surprised when this question was first presented to a group of radiologists to find out that they did not like the use of the specially coined words which were intended to simplify their problem. They preferred to go ahead wholeheartedly and adopt energy units and other basic concepts to a degree far beyond what most of the physicists present had thought would be possible.

The thoughts which we have been presenting have led workers from many countries to formulate certain informal tentative agreements regarding the introduction of new units.

First: The use of the roentgen as a unit of x- and gamma-ray quantity should be continued within the limits of radiation quality where it is practicable to meet the present definition. We would recommend some minor changes in the wording of the definition, but the average radiologist, who is using radiations below 400 kv.p. or thereabouts, will not need to know that any change has been introduced or that any new units are necessary. It is when we reach the high-energy region that these new units will be required.

Second: For the correlation of the dose of any ionizing radiation with the biological or other effects which it produces, the fundamental principle shall be to express the dose in terms of the quantity of energy transferred to a unit mass of the material irradiated, at the place concerned. And this will be expressed in ergs per gram.

Third: Recognizing the practical importance of dose determinations based on the measurement of ionization in gases, and in order to permit the accurate reporting of observations obtained by ionization measurements made under conditions where the reduction to ergs per gram is hindered by inadequate knowledge of necessary constants, the following procedure is suggested:

The ionization measurements should be made under such conditions, normally referred to as infinitesimal cavity conditions, that the ionization in the gas is produced by substantially the same flow of corpuscular radiation as exists in the material under consideration. When this procedure is followed, the result of the measurements shall be expressed in terms of the quantity of charge of either sign separated per unit mass of gas in the ionization chamber.

And *finally:* Since the calculation of the energy dose from measurements of ionization requires the knowledge of parameters and variables characterizing the radiation and the irradiated material, we shall recommend that the International Committee on Radiological Units promote the compilation and distribution of the best available data useful for this purpose.

These tentative agreements are intended to form the basis for discussion of possible official action by this Congress.

NOTE (added in proof): These agreements were adopted, with only minor changes of wording, by the Sixth International Congress of Radiology, London, 1950. They will be published, as adopted, in the January 1951 issue of RADIOLOGY.

National Bureau of Standards
Washington 25, D. C.

SUMARIO

Unidades Posológicas para la Radiación de Alta Energía

Este trabajo fué presentado en un Certamen sobre Unidades Posológicas celebrado en el Sexto Congreso Internacional de Radiología, reunido en Londres en julio de 1950. Señálase en el mismo que la definición del roentgen adoptada en 1928 ha exigido modificaciones de cuando en cuando a medida que han entrado en uso radiaciones de mayor energía, pero que en lo referente a los valores de multimillones de voltios de hoy día, el procedimiento comprendido en dicha definición ha dejado de representar la situación fundamental.

Ofrécense las siguientes indicaciones:

(1) Que se continúe usando el roentgen como unidad, siempre que sea factible dentro de los límites de la calidad de la irradiación.

(2) Que para la correlación de la dosis de cualquier radiación yonizante con los efectos biológicos u otros que produzca, el principio fundamental consista en expresar la dosis en términos de la cantidad de energía trasladada a una unidad en volumen de la sustancia irradiada en el sitio dado, dándose la expresión en ergios por gramo.

(3) Que en vista de la importancia práctica que revisten las determinaciones de la dosis basadas en la medición de la yonización en gases, y a fin de permitir la anotación exacta de las mediciones de la yonización realizadas en condiciones en las que un conocimiento inadecuado de las constantes necesarias impide la reducción a ergios por gramos, las mediciones de la yonización se hagan en tales condiciones que la yonización en el gas sea producida por una corriente de radiación corpuscular sustancialmente idéntica a la que exista en la sustancia en consideración, y que se exprese el resultado en términos de la cantidad de carga negativa o positiva separada por unidad de volumen de gas en la cámara de yonización.

(4) Que visto que el cálculo de la dosis de energía basado en las mediciones de la yonización exige conocimiento de los parámetros y las variables que caracterizan a la radiación y a la sustancia irradiada, la Comisión Internacional de Unidades Radiológicas fomente la compilación y distribución de los mejores datos disponibles que parezcan útiles para dicho fin.

A Nomogram for Dose Determinations in Diagnostic Roentgenology[1]

JOSEPH SORRENTINO, M.D., and ROSALYN YALOW, Ph.D.

New York, N. Y.

MANY PAPERS HAVE been published containing tables and charts (1, 2, 4, 5, 7, 8) designed to aid the roentgenologist in determining the number of roentgens delivered to the skin of a patient undergoing diagnostic radiologic procedures, roentgenographic, fluoroscopic, or both. Since these tables do not give the dose per milliampere-second as a continuous function of target-skin distance and of x-ray tube voltage, their usefulness is limited. In the present paper the earlier information is consolidated and used to prepare a simple nomogram which will enable a roentgenologist, using his own particular technics, to determine the skin dose received by his patients.

In a roentgenographic procedure one should attempt to produce on the film an image of suitable contrast and sufficient density with a minimum skin dose. Similarly, in a fluoroscopic examination the image on the fluorescent screen should have sufficient illumination and contrast with a minimum skin dose. Earlier work (1) has shown that to obtain this result it is advisable to use filtration of at least 1 mm. aluminum in addition to the inherent filtration of the tube. This reduces the intensity of the softer components of the x-ray spectrum which would normally be almost completely absorbed in the superficial layers of the skin, thus contributing to the skin dose without improving the radiograph or the fluoroscopic image.

It is also advisable to increase the target-skin distance. On the basis of the inverse-square law, this increases the intensity of the radiograph or fluoroscopic image for a given entrance dose. In fluoroscopy a minimum target-skin distance of 15 inches should be used where practical. In our department 18 inches have been found to be satisfactory. In radiography a minimum target-film distance of 36 inches is recommended for thick parts (8).

When x-rays were first employed for diagnostic studies, the tubes were used without external filter and the target-film distance was very short. At that time the delivery of an erythema dose was a real possibility. With modern equipment, operated by a qualified roentgenologist, delivery of an erythema dose for a single set of diagnostic studies is improbable. The chief concern at the present time is the patient with a chronic disease who is subjected to repeated radiographic and fluoroscopic procedures, sometimes in several different institutions. The accumulated dose received under such conditions may be very large. According to Handbook 41 (4) of the National Bureau of Standards, the permissible dosage rate to any part of the body of radiation workers is 0.3 r per week, making a total of about 15 r per year. This recommendation is intended for the protection of the radiation worker and not for the patient, since this limitation would make it impossible to carry out many diagnostic procedures. Although in many complete x-ray diagnostic studies it is necessary to exceed 15 r per year, one should aim at keeping the dose as low as possible to obtain the required information. In particular, indiscriminate fluoroscopic procedures should be discouraged, since in these studies the exposure to the patient may be excessive.

In Handbook 41, the average dosage

---

[1] From the Department of Radiology, Veterans Administration Hospital, Bronx, New York. Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

Accepted for publication in February 1950.

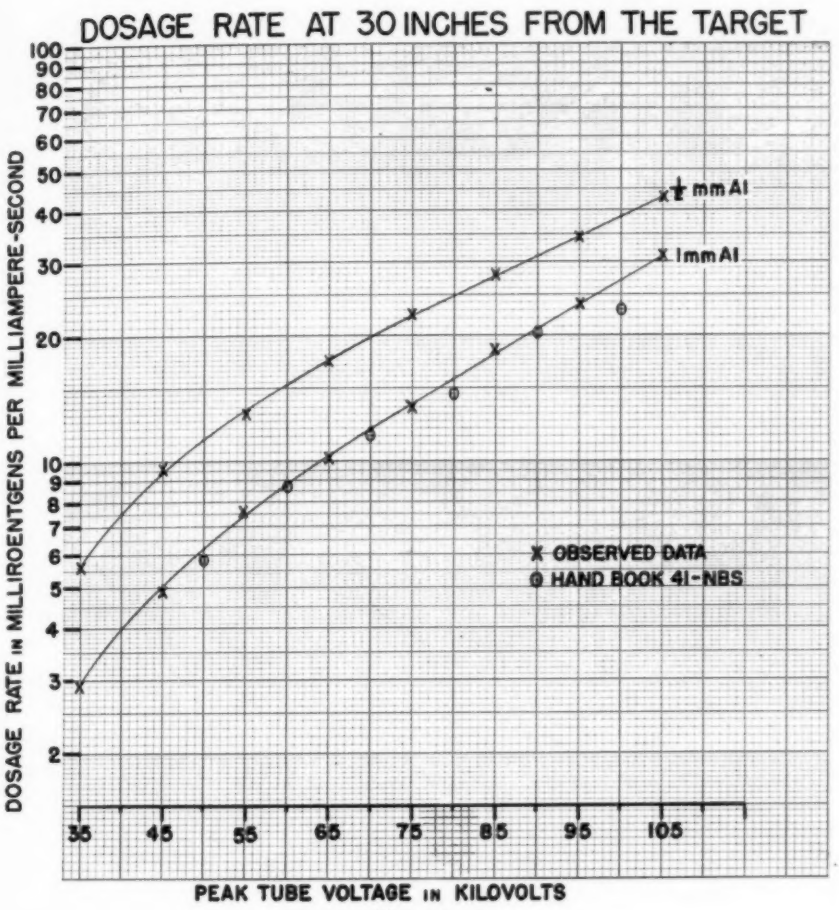


Figure 1

rates in air, in roentgens per 100 milliampere-seconds, are given for x-ray tubes with pulsating potential, with an added filter of 1.0 mm. aluminum. These figures are based on many determinations with several different kinds of tubes and high-voltage generators. Before constructing the nomogram presented in this paper, it was considered desirable to determine whether these average dosage rates could be applied to the equipment in our department. In this clinic seven diagnostic generators of two different makes are used. All the x-ray tubes have rotating anodes and operate on full-wave rectification. The inherent filtration of the tubes is equivalent to 0.5 mm. aluminum.

The first experiments were designed to determine the difference in the output of these generators when operated under conditions as nearly identical as possible. This was done in two ways. Each of the seven machines was used to obtain a radiograph of an aluminum step ladder on a different portion of the same film. The film was developed, and the density under each step was determined with a densitometer. The output of each machine was also determined with a Victoreen condenser type ionization chamber. The results of these experiments demonstrated that the difference in output was less than 10 per cent.

The next set of experiments was designed

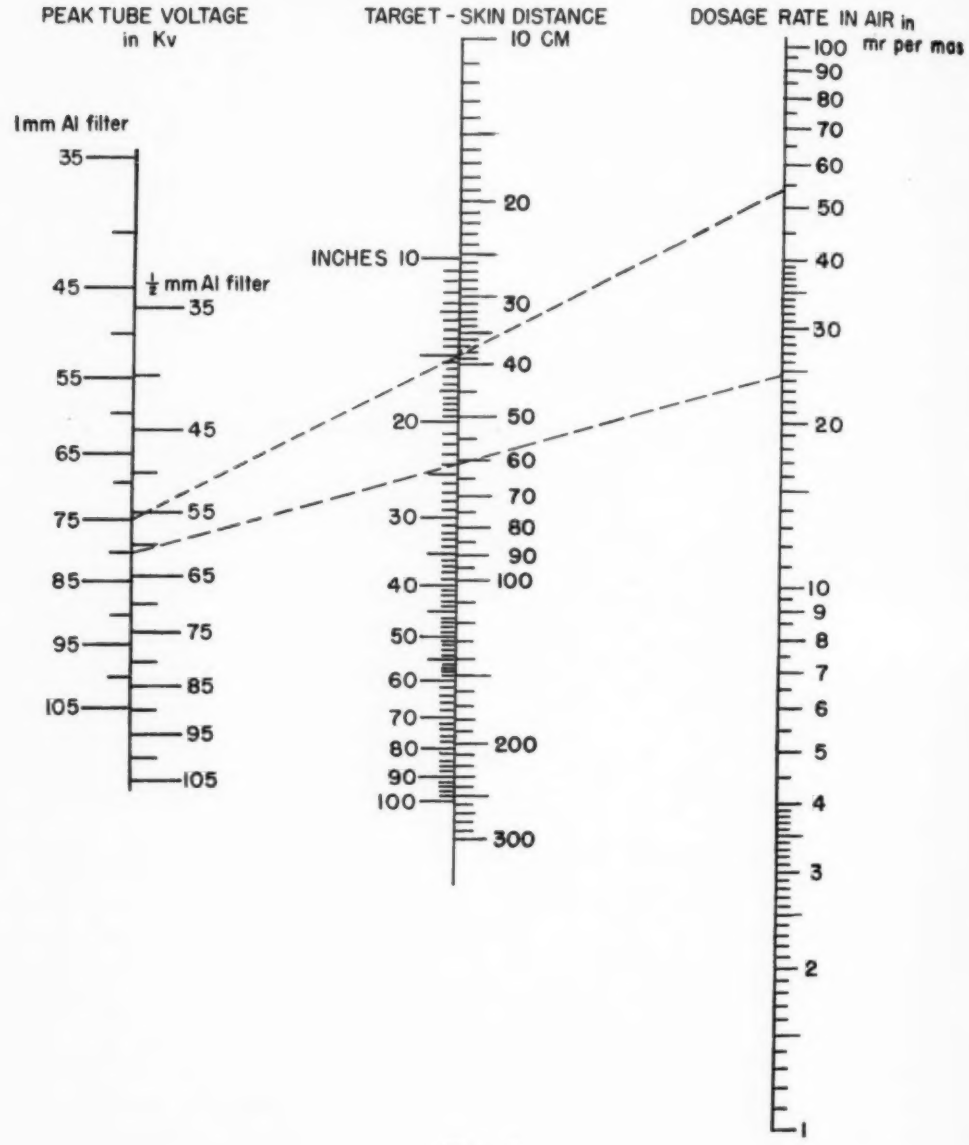


Figure 2

to determine whether the dosage rate varied inversely with the square of the distance from the target. This relationship will not hold for unfiltered radiation, because of the pronounced absorption of the softer x-ray components in air (6). X-ray intensity was measured at distances between 15 and 36 inches with additional filtration of 0,

0.5, 1.0, and 1.5 mm. aluminum. Results indicated that the inverse-square law held for filtered radiations under a wide range of conditions within the limits of the experimental error, about 10 per cent.

The dose for a known current and exposure time was measured with a Victoreen condenser type ionization chamber at a target-chamber distance of 30 inches for a voltage range of 35 to 105 kv., in steps of 10 kv., for 0.5 and 1.0 mm. additional aluminum filtration. Victoreen chamber readings were corrected for wavelength dependence.

The average x-ray output in roentgens per milliampere-second as a function of voltage for 0.5 and 1.0 mm. aluminum filtration is given in Figure 1. The curve shows that our experimental data obtained with 1 mm. additional aluminum filtration are consistent with the data contained in the National Bureau of Standards Handbook 41 (4). These results confirm the previous experimental conclusions concerning the uniform dosage rate of many different types of equipment used in this country. Hence the value of the results in this paper is enhanced, since the conclusions reached should be widely applicable.

The experiment described earlier in this paper has shown that the roentgen output per milliampere-second varies inversely with the square of the distance from the target. It is simple, then, to calculate a factor which, when multiplied by the roentgen output per milliampere-second at 30 inches target-skin distance, will give the output at any distance. This information has been incorporated into a nomogram, shown in Figure 2. Using this nomogram, Table I was constructed to give the dose in air delivered at the skin of a 220-pound, 6-foot patient for the various diagnostic procedures employed in this department. The target-skin distance is the target-film distance minus the thickness of the part being examined. Table I is of value only to those roentgenologists who employ technics identical with those used in our department. For different technics the use of the nomogram will be demonstrated using two specific examples.

Example 1: For a fluoroscopic procedure a voltage of 75 kv. with 0.5 mm. additional aluminum filter and a target-skin distance of 15 inches is employed. The examination takes 1 minute (60 seconds) at a current of 3 milliamperes for a total of 180 milliampere-seconds. It should be remembered that the table top or panel acts as an additional filter, generally equivalent to about 0.5 mm. aluminum. Therefore, the total added filtration is equivalent to 1.0 mm. aluminum. A straight edge is used to draw a line joining the point corresponding to 75 kv. on the scale marked "1.0 mm. aluminum filter," to the point corresponding to 15 inches on the scale marked "target-skin distance." The line is then continued until it intercepts the scale giving dosage in air at the skin in milliroentgens (mr.) per milliampere-second (mas.). This gives a value of 54.4 mr./mas. Multiplying this figure by 180 mas. gives 9.7 r in air at the skin of the patient for the examination.

Example 2: For a barium enema, lateral view, a voltage of 80 kv. with 1 mm. additional aluminum filter and a target-film distance of 36 inches is employed. An exposure of 200 milliampere-seconds is required for a suitable radiograph. The thickness of the part is 12 inches. The target-skin distance is $36 - 12 = 24$ inches. A line is drawn joining 80 kv. in the 1 mm. aluminum filter scale with 24 inches in the target-skin distance scale and continued until it intercepts the dosage in air scale at 24.4 mr./mas. This multiplied by 200 mas. gives a dose of 4.9 r in air at the skin for this single x-ray examination.

The nomogram in its present form can be used directly for many different types of x-ray machines which have added filters of 0.5 or 1.0 mm. of aluminum. For added filter of 1.5 mm. aluminum, the dosage rate will be approximately 11 per cent less than the values given for 1.0 mm. aluminum for 65 kv. to 105 kv. The roentgen dose in air at the skin given by the nomogram should be correct, for a given machine, to within ± 25 per cent, as reported by Braestrup (1) and confirmed by our findings.

In all the cases described above, the dosage rate is given in air at the skin. To find the actual skin dose, it is necessary to multiply the dose in air by about 1.25 to allow for back-scatter using large portals and filtered radiation (3, 6).

TABLE I

Examination	Thickness (cm.)	1 mm. Al and Kv.	Ma.-seconds	TFD (in.)	r in Air
Hand					
A-P	21	38	10	36	0.027
Obl.	4	38	10	36	0.029
Lat.	8	40	10	36	0.033
Wrist					
A-P	4	40	10	36	0.031
Obl.	5	40	10	36	0.032
Lat.	5	43	10	36	0.038
Forearm					
A-P	7	42	10	36	0.036
Lat.	7	44	10	36	0.040
Elbow					
A-P	6	45	10	36	0.041
Lat.	9	46	10	36	0.047
Arm					
A-P	7	44	10	36	0.040
Lat.	7	46	10	36	0.043
Shoulder					
A-P	15	55	100	36	0.76
Lat.	42	78	200	36	6.2
Foot					
A-P	7	38	10	36	0.032
Obl.	8	38	10	36	0.031
Lat.	7	40	10	36	0.034
Ankle					
A-P	11	46	10	36	0.049
Lat.	7	44	10	36	0.040
Foreleg					
A-P	9	47	10	36	0.049
Lat.	10	47	10	36	0.048
Knee					
A-P	12	55	10	36	0.069
Lat.	11	48	10	36	0.055
Leg					
A-P	16	57	10	36	0.079
Lat.	16	56	10	36	0.077
Hip					
A-P	21	66	100	36	1.3
Pelvis					
A-P	23	66	100	36	1.3
Cervical					
A-P	11	52	100	36	0.58
Obl.	11	62	100	36	0.81
Lat.	11	65	50	72	0.10
Dorsal					
A-P	22	70	100	36	1.4
Lat.	33	72	200	36	4.2
Lumbar					
A-P	20	67	150	36	1.9
Obl.	25	70	175	36	2.6
Lat.	31	76	300	36	6.5
Lat. spot-film	34	78	400	36	10.0
Barium enema					
A-P	20	74	100	36	1.5
Obl.	25	78	100	36	2.2
Lat.	31	80	200	36	4.9
Chest					
A-P	22	65	15	72	0.035
Obl.	25	75	15	72	0.049
Lat.	33	78	40	72	0.15
Chest (Bucky)					
A.-P	22	70	50	72	0.11
Obl.	25	76	50	72	0.16
Lat.	33	78	100	72	0.39
Heart					
A-P	22	70	15	72	0.039
Obl.	25	75	45	72	0.15
Lat.	33	80	60	72	0.25
Esophagram					
A-P	22	70	100	36	1.3
Obl.	25	75	100	36	1.9
Lat.	33	78	100	36	2.6
Ribs above diaphragm					
A-P	22	60	100	36	1.0
Obl.	25	66	100	36	1.4
Ribs below diaphragm					
A-P	23	66	100	36	1.3
Obl.	26	72	100	36	1.6
Skull					
A-P	20	68	100	36	1.3
Occip.	21	72	100	36	1.4
Lat.	15	62	100	36	0.90
Sub. vert.	24	74	100	36	1.7
Sinus					
Frontal	20	65	30	30	0.57
Waters	24	67	30	30	0.72
Lat.	15	55	20	30	0.23
Sphenoid	24	65	30	30	0.66
Mastoid tip					
A-P	20	50	30	30	0.34
Lat.	15	57	30	30	0.38
Mayer	21	70	50	30	1.1
Stenvers	21	60	30	36	0.30
Mandible					
A-P	22	62	100	36	1.1
Lat.	12	50	30	30	0.26
Temp.-mand. jt.	15	57	30	30	0.38
Nose					
Lat.	15	35	10	30	0.045
Occlusion film	19	54	50	30	0.63
Optic foramen	19	60	30	30	0.42
Orbit (cardboard)					
P-A	20	85	300	30	9.8
Lat.	15	65	200	30	3.0
Waters	24	78	550	36	10.4
Cerebro-angio. (skull)					
A-P	20	72	100	36	1.4
Lat.	15	62	100	36	0.90
Sacrum					
A-P	23	66	100	36	1.31
Lat.	36	74	300	36	7.2
KUB					
A-P	20	63	100	36	1.1
Lat.	31	73	100	36	2.0
G-I					
A-P	20	70	70	36	0.95
Obl.	25	76	70	36	1.3
Lat.	31	80	175	36	4.3
Gallbladder	20	66	100	36	1.2
A-P	25	73	100	36	1.7
Obl.					
IVP	20	66	100	36	1.2
A-P	25	70	100	36	1.6
Obl.	31	76	150	36	3.2
Lat.					

TABLE I—(*Continued*)

		Fluoroscopy			
		Kv.	Ma.	TSD	r in Air
		75	3 × 1 min.	18	6.6
		80	3 × 1 min.	18	7.7
		75	3 × 1 min.	12	15.0
		80	3 × 1 min.	12	17.3

SUMMARY

This paper presents data to enable the radiologist to determine skin dose to the patient for any diagnostic procedure, for x-rays from 35 to 105 kv., with target-skin-distance of 10 to 100 inches.

The equality of x-ray output per milliampere-second for different generators and tubes, operated under the same conditions, was investigated for seven machines. In all cases the r/mas. was found to be within ±10 per cent of the average, and to agree with the data in National Bureau of Standards Handbook 41.

On the basis of these data, a nomogram has been constructed, which will make possible the determination, to within ±25 per cent of the true value, of the dose delivered to the patient for any particular procedure. Use of the nomogram is illustrated by examples.

ACKNOWLEDGMENTS: The authors are pleased to acknowledge their indebtedness to the late Dr. Archie Sheinmel, Chief of the Department of Radiology, for his encouragement and keen interest in the project; to Mr. Carl Braestrup, of the New York City Department of Hospitals, for his advice; and to Mr. James Douglas for his assistance and cooperation in making the physical measurements.

Veterans Administration Hospital
Bronx 63, N. Y.

REFERENCES

1. BRAESTRUP, C. B.: X-Ray Protection in Diagnostic Radiology. Radiology **38:** 207–216, February 1942.
2. FILES, G. W.: Medical Radiographic Technic. Springfield, Ill., Charles C Thomas, 1943, p. 108.
3. GLASSER, O., QUIMBY, E. H., TAYLOR, L. S., AND WEATHERWAX, J. L.: Physical Foundations of Radiology, New York, Paul B. Hoeber, Inc., 1944.
4. Handbook 41. Medical X-ray Protection Up to Two Million Volts. National Committee on Radiation Protection, 1949.
5. SMEDAL, M. I.: Roentgen-Ray Dosage During Routine Diagnostic Studies. Am. J. Roentgenol. **48:** 807–815, December 1942.
6. TROUT, E. D., AND GAGER, R. M.: Physical Characteristics of Soft Roentgen Rays. Am. J. Roentgenol. **62:** 91–112, July 1949.
7. TURNBULL, A., AND LEDDY, E. T.: A Method for Determining the Limits of Safety in Roentgenography. Am. J. Roentgenol. **34:** 258–260, August 1935.
8. MARTIN, J. H.: Radiation Doses Received by the Skin of a Patient During Routine Diagnostic X-ray Examinations. Brit. J. Radiol. **20:** 279–283, July 1947.

SUMARIO

Nomograma para las Determinaciones de la Dosis en la Roentgenología de Diagnóstico

Los datos presentados capacitan al radiólogo para determinar la dosis cutánea en el enfermo para cualquier procedimiento diagnóstico que utilice rayos X de 35 a 105 kv., con una distancia foco-piel de 25 cm. a 2.5 m.

En siete aparatos, se investigó la igualdad de la producción de rayos X por miliamperio-segundo con diferentes generadores y tubos, usados en las mismas condiciones. En todos los casos, la emisión en roentgens por miliamperio-segundo quedó dentro de ±10 por ciento del promedio y convino con los datos contenidos en el Manual 41 de la Oficina Nacional de Normas y Tipos.

A base de los datos obtenidos, se ha construído un nomograma que permite determinar la dosis llevada al enfermo para cualquier procedimiento dado, en términos de ±25 por ciento del valor verdadero. Ofrécense ejemplos que demuestran el empleo del nomograma.

EDITORIAL

The Sixth International Congress of Radiology[1]

"Whatever may be the divisions of politics, the divisions of geography or, harsher still, the divisions of history, medicine remains international."—Dr. Ralston Paterson

Those who were privileged to attend the Sixth International Congress of Radiology meeting in London, July 24–28, brought back with them the inspiration of a full scientific program, the memories of delightful social occasions, and a new sense of the universality of their specialty. Fifty-four countries were represented; 1,742 radiologists were registered, and the total enrollment was 3,364.

The organization of the entire Congress reflected long months of careful planning and intensive work on the part of the President, Dr. Ralston Paterson, the Secretary-General, Dr. J. W. McLaren, and the other officers and committees. It is impossible to commend too highly the results of their labors. Everything moved with precision, from the impressive ceremony on the morning of July 24, at which the Earl of Athlone, Chancellor of the University of London, declared the Congress open, to its formal "Ringing Out" on July 28.

The headquarters of the Congress was Central Hall, Westminster. Here the opening and closing ceremonies were held, the General Congress Symposia and symposia on diagnosis and therapy were presented, and the scientific exhibits were housed. Section meetings were held also in Church House and Caxton Hall, while the Technical exhibit occupied space in the halls of the Royal Horticultural Society.

By a happy circumstance the Congress opened in the same hall that saw the assembling of the First International Congress just twenty-five years before. The ceremonies were colorful and impressive. The Congress having been declared formally open, Dr. B. H. Orndoff, representing Dr. Arthur C. Christie, President of the Fifth International Congress, invested Dr. Paterson with the badge and chain originally presented to the Congress by the British delegation as the official insignia of the President. Dr. Orndoff then called upon Dr. Hans R. Shinz of Zurich, who presented to Dr. Paterson a testimonial, signed by the three living past-presidents—Dr. Gösta Forssell, of Stockholm, Dr. Schinz, and Dr. Christie—in appreciation of the organization of the present Congress "under world conditions of exceptional difficulty."

These formalities were followed by the Presidential Address[2] reviewing the progress of radiology from the early days to the present time, when "diagnostic radiology has permeated the whole structure of medicine" and "radiotherapy has provided man with the instrument which has become the most important weapon in the fight against malignant disease." Dr. Paterson was followed by Sir Henry Dale, President of the Royal Society of Medicine, Professor Heyman of Sweden, who read a message from Professor Forssell, unfortunately prevented from attendance by illness, Dr. Manuel Madrazo of Mexico, President of the Fourth Inter-American Congress of Radiology, and Professor Paul

---

[1] The Editor is grateful to Dr. Harold W. Jacox and Dr. Ross Golden for their assistance in the preparation of this report, the former for his account of the therapeutic sessions and the latter for the summary of the business transactions.

[2] A verbatim report of the opening addresses appears in the British Journal of Radiology for September.

Lamarque of France on behalf of the radiologists of Latin language.

SCIENTIFIC SESSIONS

The scientific meetings comprised three main groups: (1) General Congress symposia, four in number; (2) a series of symposia in each of the four main subdivisions of radiology—radiodiagnosis, radiotherapy, radiobiology, and radiophysics; (3) meetings of all four sections, with the addition of electrology, at which more than 300 papers were delivered.

The first General Congress Symposium was held on Tuesday, July 25, and was devoted to Supervoltage Radiotherapy. Dr. Robert S. Stone of California contributed a paper evaluating supervoltage therapy on the basis of the late clinical effects. Dr. Odd Dahl of Norway spoke on Supervoltage Technic and Engineering, and Professor B. W. Windeyer on Therapeutic Application of Supervoltage X-rays. The second symposium in this group, held on Tuesday, had to do with Radiological Achievement, 1937–1950. It was presided over by Dr. Paterson and comprised two sessions, the speakers being Sir Stanford Cade, Dr. Edith H. Quimby, Dr. A. Lacassagne, Dr. Ross Golden, Dr. Pedro Fariñas, Dr. Knut Lindblom, Dr. John Lawrence, and Dr. Paterson. The two remaining general symposia were on Mass Radiology of the Chest, with papers by Professor Manoel de Abreu, Dr. A. C. Christie (read by Dr. Orndoff), Dr. Arne Nelson, and Dr. Peter Kerley, and Radiation Hazards, which were discussed by Professor Robley Evans, Dr. Austin Brues and Dr. Shields Warren, and Professor W. V. Mayneord.

The symposia on special aspects of radiology and the many proffered papers cannot be covered here in detail, a brief summary must suffice.

The therapeutic symposia dealt with such subjects as the clinical results of treatment of cancer, new uses and results of artificial radioactivity, and the results and technic of the treatment of cancer of the larynx and of cancer of the breast.

Although there were no startling innovations, several papers dealt with various forms of rotational therapy, including a moving convergent beam, pendulum movement and rotation with the patient in the horizontal position, as well as results of conventional rotation about a vertical axis.

Almost every possible type of radium applicator for the treatment of cancer of the uterine cervix, including the use of radioactive cobalt wires, and a revolving and a suspended radium container were described. Some of the best results in cancer of the cervix yet obtained were reported with combined external and transvaginal roentgen therapy.

Developments of new technics for both benign and malignant conditions were presented in detail. Experiences were reported with the use of "sieve" or "chess board" grid technics for the purpose of protecting some of the surrounding skin while giving a large total exposure. A variety of methods of beam direction were described, with devices aimed at greater accuracy, higher dosage and delivery of homogeneous radiation in the radical treatment of squamous carcinomas.

The diagnostic symposia included Radiology of the Small Intestines, Skeletal Changes in Diseases of the Blood, and the newer technics of Angiocardiography and Arthrography. Histology, chemistry, and genetics were dealt with by the radiobiologists, in a series of symposia which concluded with a discussion of the mode of action of ionizing radiation.

The inadequacy of the roentgen as a unit of high-energy radiation was one of the main subjects of discussion in the physics symposium on Radiological Units,[3] preparing the way for the later recommendation of the Committee on Radiological Units that measurements of radiation of energies in excess of 5 mev. be based upon energy absorbed per unit mass of tissue. Other symposia in the field of physics concerned the Acceleration of Particles and the Generation of Ionizing

[3] See page 743 of this issue of RADIOLOGY.

London News Agency Photo

The Rt. Hon. The Earl of Athlone, K.G., opening the Sixth International Congress of Radiology, Central Hall, Westminster, London, July 24, 1950.

Radiations, Radiotherapeutic Physics, and Production and Physical Properties of Radioisotopes.

The foregoing paragraphs will indicate, however inadequately, the wealth of material and high class instruction on all phases of radiology offered by lectures, symposia, exhibits, moving pictures, and post-Congress visits to hospitals in London and the Provinces, available only at an International Congress.

THE BUSINESS OF THE CONGRESS

According to the constitution, the business of the International Congress of Radiology is handled by: (1) the International Executive Committee, and (2) the International Committee. The former is relatively small, being composed of the President of the Congress, as Chairman, the three immediate Past Presidents, and the Chairmen of the delegations of seven countries which are selected by ballot by all of the national delegations before the Congress convenes. The Executive Committee reports to the International Committee, which has final authority. The latter is composed of all of the national delegations attending the Congress, but each delegation has only one vote, which is expressed by its chairman.

A brief account of some of the more important actions taken at the London meeting follows:

The International Committee voted to make the International Congress of Radiology a member of the Council for the Coordination of International Congresses of Medical Sciences (CCICMS). This Council was organized in Brussels in April 1949, by representatives of forty-two international medical societies, under the auspices of the World Health Organization (WHO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Information about any international medical meeting can be obtained from the Council, the headquarters of which is Unesco House, 19 Avenue Kléber, Paris (16e).

A resolution to change the intervals between the International Congresses of Radiology from three to four years was introduced by the delegation from Mexico. The delegation from the United States strongly supported this resolution, but it was defeated by a majority of two votes out of the thirty delegations voting.

Their experience in organizing this most recent Congress convinced the British officials that some kind of continuity between the Congresses is advisable. The British delegation, therefore, proposed the organization of a permanent structure in the nature of an "International Federation of Radiological Societies," which would involve membership and financial support by various national radiological societies. A sub-committee, appointed by the President to deal with this problem, came to the conclusion, after extensive discussion, that the available time was too short to arrange a Constitution and By-laws for a new organization. It recommended a change in the Constitution to provide for continuity between this and the next Congress, pending further discussion of an International Federation by national radiological societies. Because of the importance of this matter, the report of the sub-committee is reproduced herewith:

> The Sub-Committee is of the opinion that the time has come to initiate action for the formation of an International Federation of Radiological Societies, but it considers that no detailed proposals can be formulated at this Congress. The Sub-Committee recommends, however, that the delegates to the Sixth International Congress of Radiology should be requested to report this proposal in principle to their own National Radiological Societies, with a view to further discussion at the Seventh International Congress of Radiology at Copenhagen, with the intent that each National Radiological Society shall instruct its delegate to the Seventh International Congress to express its opinion on the desirability of the formation of such a federation. It is pointed out that such a proposal involves financial as well as moral support, possibly to the extent of 3 per cent of the collected membership subscriptions or dues.
>
> The Sub-Committee further recommends that, in the meantime, the Constitution of the International Congress of Radiology be amended by the addition of the following paragraphs (the proposed new matter is italicized):

The National Board of Management

20. The President of the Congress shall, in consultation with the delegates from the country where the Congress is to be held, appoint the Board of Management, the General Secretary and all the other officials.

21. The National Board of Management of the Congress shall be entirely responsible for all the Congress arrangements, financial and otherwise.

21a. (I) *For the purposes of securing continuity in the organization of International Congresses, the National Board of Management shall appoint an Executive Secretary, who shall be paid from the funds of the Congress.*

(II) *The Executive Secretary shall be appointed two years before the date fixed for the commencement of the next Congress and shall continue to be employed for one year thereafter.*

(III) *During the year following the Congress, it shall be the duty of the Executive Secretary to prepare a detailed report, including a full financial report, on the working and organization of the Congress; to obtain and keep up-to-date lists of the memberships of all National Radiological Societies; to collect all such other information as may be of assistance to the National Board of Management in the organization of the forthcoming Congress; and, on the direction of the Secretary-General, to make recommendations on organization.*

(IV) *The National Board of Management shall decide whether it employs the same person as its Executive Secretary as was employed by the previous Congress, or whether it employs a different person. If the National Board of Management employs a different person, it shall provide for the fullest possible consultation and exchange of information between the outgoing and the incoming Executive Secretaries, including a period of overlap, not exceeding six months, in the services of the respective Executive Secretaries.*

Ross Golden, *Chairman*
Hermann Holthusen
Felix Leborgne
P. Fleming Møller

The International Commission on Radiological Protection and the International Commission on Radiological Units presented important reports which will be published later in detail. The United States was represented on the former by Lauriston Taylor and Robert R. Newell, and on the latter by Lauriston Taylor, G. Failla, and Robert R. Newell.

At the request of the Commission on Radiological Protection, the International Committee resolved that this important commission shall be composed of not more than twelve members, that members shall be selected by the International Executive Committee from a list of nominations submitted by the National Delegations and by the Commission itself, that these members shall be chosen on the basis of their recognized activities in the field of radiology and allied sciences without regard to nationality, and that the Commission shall be authorized to form sub-committees, including additional individuals selected by itself, for the purpose of dealing with detailed studies in specialized fields.

A recommendation by the delegation from the United States that a committee similar to the International Units Commission and the International Protection Commission be established to study the problem of classification and grading of cancer and the presentation of the results of treatment of cancer was adopted and the following committee was appointed: Professor J. Heyman, Sweden, *Chairman;* Dr. J. Clemmensen, Denmark; Dr. R. Denoix, France; Professor H. Holthusen, Germany; Dr. F. Leborgne, Uruguay; Professor J. Maisin, Belgium; Dr. K. P. Mody, India; Professor R. McWhirter, Great Britain; Professor F. Perussia, Italy; Dr. U. V. Portmann, U.S.A.; Professor H. R. Schinz, Switzerland; Dr. A. Sellars, Canada.

President Paterson announced the establishment in Paris of the Béclère Foundation (Le Centre Antoine Béclère des Relations Internationales en Radiologie Médicale) by Mlle. Antoinette Béclère and Dr. Claude Béclère, in honor of their father, Dr. Antoine Béclère, President of the Third International Congress, and appointed Dr. Arthur C. Christie of Washington and Professor Gösta Forssell of Stockholm, with Professor Hans Schinz of Zürich as alternate, as the unofficial representatives of the International Congress of Radiology on the Board of the Foundation.

The Radiological Societies of Denmark, Italy, and Uruguay presented invitations to hold the next International Congress in their respective countries. By ballot, the International Committee accepted the invitation of Denmark. The National Dele-

gation from Denmark then announced that Professor Dr. P. Fleming Møller would be President of the Seventh International Congress and that the meeting would be held in Copenhagen in the summer of 1953.

The British Faculty of Radiologists, under the Presidency of Professor Brian Windeyer, presented Honorary Fellowships to Dr. Arthur C. Christie of Washington and to Dr. George E. Pfahler of Philadelphia.

At the Closing Exercises, Drs. Christie, Forssell, Orndoff, and Schinz were honored by the presentation of replicas of the Presidential Medallion prepared by the British radiologists. A brass bell made in the fifteenth century was presented to the International Congress by the British radiologists. This bell was used at the opening and the closing ceremonies to "ring in" and to "ring out" the Sixth International Congress of Radiology.

THE SOCIAL PROGRAM

There remains only to add a brief account of the social program arranged for the delegates and guests of the Congress. A full description would require far more space than is here available. The outstanding occasions were the dinner to the International Committee, held with much pomp and circumstance at the Guildhall, with the Lord Mayor of London and Earl Mountbatten of Burma as guests of honor; the theater party at the Royal Opera House; a Garden Fete, including an elaborate program of folk-dancing, archery, fencing, and other sports, as well as a spectacular display of fireworks; and finally the colorful Congress Ball at the Savoy on the last evening of the Congress.

Receptions were tendered to the delegates and their associates by the British Faculty of Radiologists, the British Institute of Radiology, and other organizations representative of British medicine, as well as by the University of London and H.M. Government. For the ladies' entertainment there were added numerous sightseeing tours about London and excursions to Hampton Court, Windsor Castle, and other points of interest. In short, the British proved themselves royal hosts and made the Sixth International Congress of Radiology one long to be remembered.

ANNOUNCEMENTS AND BOOK REVIEWS

THE AMERICAN ROENTGEN RAY SOCIETY

The American Roentgen Ray Society held its Fifty-first Annual Meeting at the Hotel Jefferson, St. Louis, Sept. 26–29, at the same time celebrating the fiftieth anniversary of its founding. In commemoration of this Golden Anniversary there was issued under the direction of the Local Committee on Arrangements (Dr. Wendell G. Scott, Chairman) a most attractive brochure, including an account of the organization of the Society, by Dr. Edward H. Skinner, facsimile pages from early issues of the *American X-Ray Journal*, papers on "Fifty Years of Trials and Tribulations in Radiology" and "Fifty Years of Progress" by Dr. George E. Pfahler and Dr. Arthur C. Christie, respectively, and a carefully compiled list of "Milestones in Radiology" by Dr. Otto Glasser. Photographs of Roentgen and the Curies furnish an appropriate frontispiece. Of even greater interest are the photograph of the charter members of the Society, the group photograph taken at the meeting in Niagara Falls in 1906, and the portraits of the Past-Presidents, among whom are many of America's most distinguished radiologists.

RADIOLOGY extends to the American Roentgen Ray Society its congratulations on fifty years of notable achievement.

The new officers of the Society are: Dr. Bernard P. Widmann, of Philadelphia, President; Dr. H. Dabney Kerr, of Iowa City, President-Elect; Dr. Harold G. Reineke, of Cincinnati, First Vice-President; Dr. Ralph M. Caulk, Washington, D. C., Second Vice-President; Dr. Barton R. Young, Philadelphia, Secretary; Dr. Wendell G. Scott, St. Louis, Treasurer.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY

The newly elected officers of the Detroit Roentgen Ray and Radium Society are: Dr. William A. Evans, President; Dr. Horace Porter, Vice-President; Dr. James C. Cook, Harper Hospital, Detroit 1, Secretary-Treasurer.

FLORIDA RADIOLOGICAL SOCIETY

At a recent meeting of the Florida Radiological Society, the following officers were elected for the ensuing year: F. K. Hurt, M.D., of Jacksonville, President; John J. McGuire, M.D., of Pensacola, Vice-President; Thos. H. Lipscomb, M.D., 30 West Beaver St., Jacksonville 2, Secretary-Treasurer.

INDIANA ROENTGEN SOCIETY

At the Annual Meeting of the Indiana Roentgen Society, Dr. Kenneth L. Olson of South Bend was elected President; Dr. G. H. Wisener of Richmond Vice-President; Dr. William M. Loehr of Indianapolis Secretary-Treasurer.

A specially called meeting of the Society was held on Aug. 16, at which the motion picture, "Medical Effects of the Atomic Bomb," prepared by the Armed Forces Institute of Pathology, was shown and information and discussion were presented relative to radiological aspects of medical service planned for A-bomb attack. A resolution was adopted offering the services of members of the Indiana Roentgen Society to the Indiana State Advisory Committee on Emergency Medical and Health Services and to the Indiana State Board of Health, "to aid in any way desired to promote, advise and assist in the development of plans for radiological defense."

SEPTIMAS JORNADAS RADIOLÓGICAS ARGENTINAS

The Seventh Argentinian Radiological Meeting (Septimas Jornadas Radiológicas Argentinas) was held in Rosario, Argentina, Nov. 10–12. The scientific sessions of the meeting were conducted at the Círculo Médico de Rosario, under the auspices of the Filial del Litoral of the Sociedad Argentina de Radiología. The program was arranged by the Executive Committee, headed by Dr. Francisco Pablo Cifarelli, and included three central topics: (1) Angiocardiography, (2) Roentgen Therapy in Blood Diseases, and (3) X-Ray Study of Abdominal Tumors.

SYMPOSIUM ON ISOTOPES AMERICAN CHEMICAL SOCIETY

Announcement has previously been made of the Symposium on Isotopes to be held under the auspices of the American Chemical Society Friday, Jan. 19, 1951, at the Hotel Statler, New York City. The following program has been arranged:

Afternoon Session: 2:00–5:00 P.M.

2:00–2:15: Introductory Remarks, Dr. Paul C. Aebersold, Chief, Isotopes Division, U. S. Atomic Energy Commission

2:15–3:00: Organic Presentation: Carbon 14 and New Frontiers of Organic Chemistry, Dr. Charles E. Crompton, Radioisotopes Branch, Isotopes Division, U. S. Atomic Energy Commission.

3:00–3:45: Inorganic Presentation: Nuclear Inorganic Chemistry, Dr. Charles D. Coryell, Professor of Chemistry, Massachusetts Institute of Technology.

3:45–4:30: Biochemistry Presentation: Some Applications of Radioactive Isotopes in Biochemis-

try, Dr. David Rittenberg, College of Physicians and Surgeons, Columbia University.
4:30–5:00: Panel Discussion

Evening Session: 7:30–10:30 P.M.

7:30–7:45: Introductory Remarks, Dr. Aebersold.
7:45–8:30: General Industrial Application Presentation: The Commercial Potential of Nuclear Radiation Sources, Dr. F. C. Henriques, Jr., Technical Director, Tracerlab, Inc., Boston.
8:30–9:15: Petroleum Presentation: The Use of Radioisotopes in the Petroleum Industry, Dr. Paul H. Emmett, Senior Fellow, Mellon Institute of Industrial Research, University of Pittsburgh.
9:15–10:00: All-Around Presentation: Principles of Radioisotopes Technology, Dr. Charles Rosenblum, Research and Development Division, Merck & Co., Newark, N. J.
10:00–10:30: Panel Discussion

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The 117th Meeting of the American Association for the Advancement of Science will be held in Cleveland, Ohio, Dec. 26–30, 1950. Of special interest to radiologists will be the four-session Symposium on Biological Effects of Radiation, in the Subsection of Medicine, and the exhibit of the American Museum of Atomic Energy, including a model of an atomic pile.

Details as to the program and hotel reservations appear in current issues of *Science*.

SLIDE RULE FOR COMPUTING RADIOACTIVITY DECAY FACTORS

The scientist or technician concerned with the measurement of radioactivity is always confronted with the necessity of knowing the strength of a source at some particular time other than that at which it was last measured. This requires knowledge of the half-value period, or the decay constant, from which the decay correction-factor can be computed from the conventional formula. To facilitate this procedure, J. L. Herson of the Radioactivity Laboratory at the National Bureau of Standards has devised a special slide rule as an effective time saver when many computations of decay factors are involved. The slide rule includes two scales laid off side by side and properly chosen to provide a graphic computation of the relationship expressed in the usual decay-correction formula.

Books Received

Books received are acknowledged under this heading, and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

THE RESULTS OF RADIUM AND X-RAY THERAPY IN MALIGNANT DISEASE, Being the Third Statistical Report from the Radium Institute, The Christie Hospital and Holt Radium Institute, Manchester. Years 1940 to 1944 inclusive assessed at 5 years and 1934 to 1938 assessed at 10 years. Compiled by RALSTON PATERSON, MARGARET TOD AND MARION RUSSELL. A volume of 168 pages, with 63 tables. Published by E. &. S. Livingstone, Ltd., Edinburgh, 1950. Price $2.50.

THE CANCER PATIENT. A NEW CHEMOTHERAPY IN ADVANCED CASES. By B. A. MEYER, M.B., Ch.B. (Ed.), L.R.C.S. & P. (Ed. & Glas.) AND I. S. ORGEL, M.D. (Dublin). A volume of 88 pages. Published by J. & A. Churchill, Ltd., London, 1950. Price 7s. 6d.

THE MEDICAL ANNUAL. A YEAR BOOK OF TREATMENT AND PRACTITIONERS' INDEX. Editors: SIR HENRY TIDY, K.B.E., M.A., M.D. (Oxon), F.R.C.P., AND A. RENDLE SHORT, M.D., B.S., B.Sc., F.R.C.S. A volume of 440 pages. Published by John Wright & Sons Ltd., Bristol, and Simpkin Marshall, Ltd., London, 1950.

THE AMERICAN ROENTGEN RAY SOCIETY 1900–1950. Commemorating the Golden Anniversary of the Society. A brochure of 56 pages, with numerous photographs. Published by Charles C Thomas, Springfield, Ill., 1950. Price $2.00.

VERNAL CONJUNCTIVITIS. By M. N. BEIGELMAN, M.D., Clinical Professor of Surgery (Ophthalmology), University of Southern California School of Medicine; Senior Attending Ophthalmologist, Cedars of Lebanon Hospital; Attending Eye Pathologist, Los Angeles County Hospital. With a foreword by SIR W. STEWART DUKE-ELDER, K.C.V.O., M.A., D.Sc. (St. And.), Ph.D. (Lond.), M.D., Ch.B., F.R.C.S., Hon. D.Sc. (Northwestern). A volume of 430 pages, with 49 illustrations and 14 tables. Published by the University of Southern California Press, Los Angeles 1950. Price $6.00.

LEHRBUCH DER RÖNTGENDIAGNOSTIK. By H. R. SCHINZ, W. E. BAENSCH, E. FRIEDL, E. UEHLINGER, with contributions by E. BRANDENBERGER, A. BRUNNER, U. COCCHI, N. P. G. EDLING, J. EGGERT, F. K. FISCHER, M. HOLZMANN, H. KRAYENBÜHL, Å. LINDBOM, E. LINDGREN, G. A. PREISS, S. WELIN, AND A. ZUPPINGER, Volume I. The Skeletal System. Part II. A volume of 452 pages, with 764 illustrations. Published by Georg Thieme, Stuttgart, 5th, completely revised edition, 1950. Sole distributors for the U.S.A. and Canada: Grune & Stratton, Inc., New York.

Book Reviews

KLINISCHE PATHOLOGIE DER BLUTKRANKHEITEN. By PROF. DR. RUDOLF SCHOEN AND PROF. DR. WALTER TISCHENDORF, of the Medical University Clinic at Göttingen. A volume of 522 pages, with 101 illustrations. Published by Georg Thieme, Stuttgart, 1950. Agents for United States, Grune & Stratton, Inc., New York.

This volume covers the entire field of clinical hematology much in the fashion of the recent American and English works on the subject. The authors are to be particularly commended for their numerous excellent graphic and tabular summaries outlining the text material. The bibliography is unusually extensive and is of interest in that it covers the hard-to-get-at hematologic reports of Central Europe at the time of recent hostilities.

In Memoriam

ROBERT HERVEY LAFFERTY

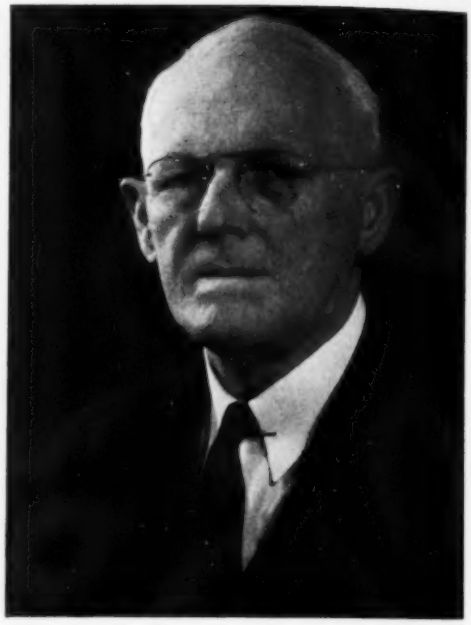
1878–1950

Robert Hervey Lafferty died of acute leukemia in Charlotte, North Carolina, July 31, 1950, at the age of seventy-two, having been confined to bed less than two weeks.

Bob Lafferty was born in Davidson, North Carolina, on August 28, 1878, the son of James Stewart Lafferty, M.D., a country doctor, and Hattie Kerns Lafferty. After receiving his A.B. and M.A. degrees in chemistry from Davidson College, he taught in the schools of North Carolina and Florida for several years. He was later graduated from the North Carolina Medical College and followed this with postgraduate work at the University of Chicago. He served as registrar and professor of chemistry and physiology at his Alma Mater for several years.

Dr. Lafferty began private practice in 1915, in Urology and Radiology, and two years later limited his practice to Radiology. During World War I, he did all of the x-ray work for Camp Greene, a camp of 65,000 men, in his office. In 1918 he was joined by Dr. Clyde C. Phillips, who died in 1939, and in 1937 Dr. O. D. Baxter became associated with Drs. Lafferty and Phillips. At the time of Dr. Lafferty's death the group included also Dr. John O. Lafferty, his younger son, and Dr. James B. Hall.

Dr. Lafferty was a member of the Mecklenburg County Medical Society, North Carolina Medical Society, Southern Medical Association, American Roentgen Ray Society, and the Radiological Society of North America, which he served as Vice-President and as a member of the Executive Committee. He was a Fellow of the American Medical Association, a charter member and Fellow of the American College of Radiology, and one of a group that organized the Radiology Section of the Southern Medical Association.



Robert Hervey Lafferty, M.D.

Religious and civic affairs claimed a good y share of Dr. Lafferty's attention. He was for thir.y years superintendent of the Sunday School of the Second Presbyterian Church and long served as an elder in that church. He had been a director of the Charlotte Y.M.C.A. and on the local executive council of the Boy Scouts of America. For years he was interested in horticulture and grew some of the finest iris his section of the country had ever seen, until forced to give up this work because of irradiation dermatitis of his hands, a product of his early work, before the elements of protection were well understood. He was the author of many papers and recently had published a History of the North Carolina Medical College. At the time of his death he was working on a History of the Second Presbyterian Church of Charlotte.

Dr. Lafferty will be missed by an unusually large number of close friends and particularly by his associates. We all feel, however, that we are better doctors and men for having known him and having been associated with him. He is survived by his wife, the former Edith K. Fry, and by two sons, Dr. R. H. Lafferty, Jr., of Oak Ridge, Tenn., and Dr. John O. Lafferty, who was associated with him in practice.

O. D. BAXTER, M.D.

RADIOLOGICAL SOCIETIES: SECRETARIES AND MEETING DATES

Editor's Note: Secretaries of state and local radiological societies are requested to co-operate in keeping this section up-to-date by notifying the editor promptly of changes in officers and meeting dates.

RADIOLOGICAL SOCIETY OF NORTH AMERICA. *Secretary-Treasurer*, Donald S. Childs, M.D., 713 E. Genesee St., Syracuse 2, N. Y.

AMERICAN RADIUM SOCIETY. *Secretary*, John E. Wirth, M.D., Baltimore, Md.

AMERICAN ROENTGEN RAY SOCIETY. *Secretary*, Barton R. Young, M.D., Germantown Hospital, Philadelphia 44, Penna.

AMERICAN COLLEGE OF RADIOLOGY. *Secretary*, William C. Stronach, 20 N. Wacker Dr., Chicago 6, Ill.

SECTION ON RADIOLOGY, A. M. A. *Secretary*, Paul C. Hodges, M.D., 950 East 59th St., Chicago 37.

Alabama

ALABAMA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. D. Anderson, M.D., 420 10th St., Tuscaloosa.

Arizona

ARIZONA ASSOCIATION OF PATHOLOGISTS AND RADIOLOGISTS. *Secretary*, R. Lee Foster, M.D., 507 Professional Bldg., Phoenix.

Arkansas

ARKANSAS RADIOLOGICAL SOCIETY. *Secretary*, Fred Hames, M.D., Pine Bluff. Meets every three months and at meeting of State Medical Society.

California

CALIFORNIA MEDICAL ASSOCIATION, SECTION ON RADIOLOGY. *Secretary*, Sydney F. Thomas, M.D., Palo Alto Clinic, Palo Alto.

EAST BAY ROENTGEN SOCIETY. *Secretary*, Dan Tucker, M.D., 434 30th St., Oakland 9. Meets monthly, first Thursday, at Peralta Hospital.

LOS ANGELES RADIOLOGICAL SOCIETY. *Secretary*, Harold P. Tompkins, M.D., 658 South Westlake Ave. Meets monthly, second Wednesday, County Society Bldg.

NORTHERN CALIFORNIA RADIOLOGICAL CLUB. *Secretary*, Clifford W. Wauters, 701 High St., Auburn. Meets at dinner last Monday of September, November, January, March, and May.

PACIFIC ROENTGEN SOCIETY. *Secretary*, L. Henry Garland, M.D., 450 Sutter St., San Francisco 8. Meets annually with State Medical Association.

SAN DIEGO ROENTGEN SOCIETY. *Secretary*, R. F. Niehaus, M.D., 1831 Fourth Ave., San Diego. Meets first Wednesday of each month.

X-RAY STUDY CLUB OF SAN FRANCISCO. *Secretary*, Merrell A. Sisson, M.D., 450 Sutter St., San Francisco 8. Meets third Thursday at 7:45, January to June at Stanford University Hospital, July to December at San Francisco Hospital.

Colorado

COLORADO RADIOLOGICAL SOCIETY. *Secretary*, Paul E. RePass, M.D., 306 Republic Bldg., Denver 2. Meets monthly, third Friday, at University of Colorado Medical Center or Denver Athletic Club.

Connecticut

CONNECTICUT STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Fred Zaff, M.D., 135 Whitney Ave., New Haven. Meetings bimonthly, second Wednesday.

CONNECTICUT VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Ellwood W. Godfrey, M.D., 1676 Boulevard, W. Hartford. Meets second Friday of October and April.

District of Columbia

RADIOLOGICAL SECTION, DISTRICT OF COLUMBIA MEDICAL SOCIETY. *Secretary*, Karl C. Corley, M.D., 1835 Eye St. N.W., Washington 6. Meets third Thursday, January, March, May, and October, at 8:00 P.M., in Medical Society Auditorium.

Florida

FLORIDA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Thos. H. Lipscomb, M.D., 30 West Beaver St., Jacksonville, 2. Meets in April and in November.

GREATER MIAMI RADIOLOGICAL SOCIETY. *Secretary*, David Kirsh, M.D., 712 duPont Bldg., Miami 32. Meets monthly, last Wednesday, 8:00 P.M.

Georgia

ATLANTA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Ted F. Leigh, M.D., Emory University Hospital. Meets second Friday, September to May.

GEORGIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Robert C. Pendergrass, M.D., Americus. Meets in November and at the annual meeting of State Medical Association.

Illinois

CHICAGO ROENTGEN SOCIETY. *Secretary*, Benjamin D. Braun, M.D., 6 N. Michigan Ave., Chicago 11. Meets at the University Club, second Thursday of October, November, January, February, March, and April at 8:00 P.M.

ILLINOIS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, William DeHollander, M.D., St. Johns' Hospital, Springfield. Meetings quarterly as announced.

ILLINOIS STATE MEDICAL SOCIETY, SECTION ON RADIOLOGY. *Secretary*, Willard C. Smullen, M.D., St. Mary's Hospital, Decatur.

Indiana

INDIANA ROENTGEN SOCIETY. *Secretary-Treasurer*, William M. Loehr, M.D., 712 Hume-Mansur Bldg., Indianapolis 4. Annual meeting in May.

Iowa

IOWA X-RAY CLUB. *Secretary*, Arthur W. Erskine, M.D., 326 Higley Building, Cedar Rapids. Meets during annual session of State Medical Society.

Kansas

KANSAS RADIOLOGICAL SOCIETY. *Secretary*, Anthony F. Rossitto, M.D., Wichita Hospital, Wichita. Meets annually with State Medical Society.

Kentucky

LOUISVILLE RADIOLOGICAL SOCIETY, *Secretary*, Everett L. Pirkey, M.D., Louisville General Hospital. Meets monthly, second Friday, at Seelbach Hotel.

Louisiana

LOUISIANA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Johnson R. Anderson, M.D., No. Louisiana Sanitarium, Shreveport. Meets with State Medical Society.

ORLEANS PARISH RADIOLOGICAL SOCIETY. *Secretary*, Joseph V. Schlosser, M.D., Charity Hospital of Louisiana, New Orleans 13. Meets first Tuesday of each month.

SHREVEPORT RADIOLOGICAL CLUB, *Secretary*, Oscar O. Jones, M.D., 2622 Greenwood Road. Meets monthly September to May, third Wednesday.

Maine

MAINE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Clark F. Miller, M.D., Central Maine General Hospital, Lewiston.

Maryland

BALTIMORE CITY MEDICAL SOCIETY, RADIOLOGICAL SECTION. *Secretary*, J. Howard Franz, M.D., 1127 St. Paul St., Baltimore 2.

Michigan

DETROIT X-RAY AND RADIUM SOCIETY. *Secretary*, James C. Cook, M.D., Harper Hospital, Detroit 1. Meetings first Thursday, October to May, at Wayne County Medical Society club rooms.

MICHIGAN ASSOCIATION OF ROENTGENOLOGISTS. *Secretary-Treasurer*, R. B. MacDuff, M.D., 220 Genesee Bank Building, Flint 3.

Minnesota

MINNESOTA RADIOLOGICAL SOCIETY. *Secretary*, Leo A. Nash, M.D., 572 Lowry Medical Arts Bldg., St. Paul 2. Meets in Spring and Fall.

Missouri

RADIOLOGICAL SOCIETY OF GREATER KANSAS CITY. *Secretary*, Wm. M. Kitchen, M.D., 1010 Rialto Building, Kansas City 6, Mo. Meetings last Friday of each month.

ST. LOUIS SOCIETY OF RADIOLOGISTS. *Secretary*, H. R Senturia, M.D., Pasteur Medical Bldg. Meets on fourth Wednesday, October to May.

Nebraska

NEBRASKA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John E. Downing, M.D., 816 Medical Arts Bldg., Omaha. Meets fourth Thursday of each month at 6 P.M. in Omaha or Lincoln.

New England

NEW ENGLAND ROENTGEN RAY SOCIETY. *Secretary*, L. L. Robbins, M.D., Massachusetts General Hospital, Boston 14. Meets monthly on third Friday at the Harvard Club.

New Hampshire

NEW HAMPSHIRE ROENTGEN SOCIETY. *Secretary*, Albert C. Johnston, M.D., Elliot Community Hospital, Keene. Meetings quarterly in Concord.

New Jersey

RADIOLOGICAL SOCIETY OF NEW JERSEY. *Secretary*, Peter J. Gianquinto, M.D., 685 High St., Newark 2. Meets at Atlantic City at time of State Medical Society and midwinter in Elizabeth.

New York

ASSOCIATED RADIOLOGISTS OF NEW YORK, INC. *Secretary*, William J. Francis, M.D., East Rockaway.

BROOKLYN ROENTGEN RAY SOCIETY. *Secretary*, J. Daversa, M.D., 603 Fourth Ave., Brooklyn. Meets fourth Tuesday, October to April.

BUFFALO RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Mario C. Gian, M.D., 610 Niagara St., Buffalo 1. Meetings second Monday, October to May.

CENTRAL NEW YORK ROENTGEN SOCIETY. *Secretary*, Dwight V. Needham, M.D., 608 E. Genesee St., Syracuse 10. Meetings January, May, October.

KINGS COUNTY RADIOLOGICAL SOCIETY. *Secretary*, Marcus Wiener, M.D., 1430 48th St., Brooklyn 19. Meetings fourth Thursday evening, October to May, at 8:45 P.M., in Kings County Medical Bldg.

NEW YORK ROENTGEN SOCIETY. *Secretary*, John L. Olpp, M.D., 49 Ivy Lane, Tenafly, N. J.

QUEENS ROENTGEN RAY SOCIETY. *Secretary*, Jacob E. Goldstein, M.D., 88–29 163rd St., Jamaica 3. Meets fourth Monday of each month.

ROCHESTER ROENTGEN-RAY SOCIETY. *Secretary-Treasurer*, A. Vaughn Winchell, M.D., 40 Meigs St. Meets at Strong Memorial Hospital, last Monday of each month, September through May.

North Carolina

RADIOLOGICAL SOCIETY OF NORTH CAROLINA. *Secretary*, James E. Hemphill, M.D., Professional Bldg., Charlotte 2. Meets in May and October.

North Dakota

NORTH DAKOTA RADIOLOGICAL SOCIETY. *Secretary*, Charles Heilman, M.D., 807 Broadway, Fargo.

Ohio

OHIO STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Edward C. Elsey, M.D., 927 Carew Tower, Cincinnati 2. Meets with State Medical Association.

CENTRAL OHIO RADIOLOGICAL SOCIETY. *Secretary*, Frank A. Riebel, M.D., 15 W. Goodale St., Columbus. Meets second Thursday, October, December, February, April, and June, 6:30 P.M., Columbus Athletic Club, Columbus.

CINCINNATI RADIOLOGICAL SOCIETY. *Secretary*, Edward C. Elsey, M.D. Meets last Monday, September to May.

CLEVELAND RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, John R. Hannan, M.D., 10515 Carnegie Ave., Cleveland 6. Meetings at 6:45 P.M. on fourth Monday, October to April, inclusive

MIAMI VALLEY RADIOLOGICAL SOCIETY. *Secretary*, Geo. A. Nicoll, M.D., Miami Valley Hospital, Dayton. Meets monthly, second Friday.

Oklahoma

OKLAHOMA STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, W. E. Brown, M.D., 21st and Xanthus, Tulsa 4. Meets in October, January, and May.

Oregon

OREGON RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, C. Todd Jessell, M.D., 224 Medical-Dental Bldg., Portland 5. Meets monthly, on the second Wednesday, at 8:00 P.M., in the library of the University of Oregon Medical School.

Pacific Northwest

PACIFIC NORTHWEST RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Sydney J. Hawley, M.D., 1320 Madison St., Seattle 4. Meets annually in May.

Pennsylvania

PENNSYLVANIA RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, James M. Converse, M.D., 416 Pine St., Williamsport 8. Meets annually.

PHILADELPHIA ROENTGEN RAY SOCIETY. *Secretary*, George P. Keefer, M.D., American Oncologic Hospital, Philadelphia 4. Meets first Thursday of each month at 8:00 P.M., from October to May, in Thomson Hall, College of Physicians, 21 S. 22nd St.

PITTSBURGH ROENTGEN SOCIETY. *Secretary-Treasurer*, Edwin J. Euphrat, M.D., 3500 Fifth Ave., Pittsburgh 13. Meets monthly, second Wednesday, at 6:30 P.M., October to May, at Webster Hall.

Rocky Mountain States

ROCKY MOUNTAIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Maurice D. Frazer, M.D., Lincoln Clinic, Lincoln, Nebr.

South Carolina

SOUTH CAROLINA X-RAY SOCIETY. *Secretary-Treasurer*, S. H. Fisher, M.D., 107 E. North St., Greenville. Meets with State Medical Association in May.

South Dakota

RADIOLOGICAL SOCIETY OF SOUTH DAKOTA. *Secretary-Treasurer*, Marianne Wallis, M.D., 1200 E. Fifth Ave., Mitchell. Meets with State Medical Society.

Tennessee

MEMPHIS ROENTGEN CLUB. Meetings second Tuesday of each month at University Center.

TENNESSEE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, J. Marsh Frère, M.D., 707 Walnut St., Chattanooga. Meets annually with State Medical Society in April.

Texas

DALLAS-FORT WORTH ROENTGEN STUDY CLUB. *Secretary*, X. R. Hyde, M.D., Medical Arts Bldg., Fort Worth 2. Meets monthly, third Monday, in Dallas odd months, Fort Worth even months.

HOUSTON X-RAY CLUB. *Secretary*, Curtis H. Burge, M.D., 3020 San Jacinto, Houston 4. Meetings fourth Monday of each month.

TEXAS RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. P. O'Bannon, M.D., 650 Fifth Ave., Fort Worth. Next meeting, Jan. 19–20, 1951, in Galveston.

Utah

UTAH STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Angus K. Wilson, M.D., 343 S. Main St., Salt Lake City. Meets third Wednesday, January, March, May, September, November.

Virginia

VIRGINIA RADIOLOGICAL SOCIETY. *Secretary*, P. B. Parsons, M.D., Norfolk General Hospital, Norfolk.

Washington

WASHINGTON STATE RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, R. C. Kiltz, M.D., 705 Medical-Dental Bldg., Everett. Meetings fourth Monday, October through May, at College Club, Seattle.

Wisconsin

MILWAUKEE ROENTGEN RAY SOCIETY. *Secretary-Treasurer*, Theodore J. Pfeffer, M.D., 839 N. Marshall St., Milwaukee 2. Meets monthly on second Monday at the University Club.

RADIOLOGICAL SECTION OF THE WISCONSIN STATE MEDICAL SOCIETY. *Secretary*, Abraham Melamed, M.D., 425 E. Wisconsin Ave., Milwaukee. Meets in May and with State Medical Society, September.

UNIVERSITY OF WISCONSIN RADIOLOGICAL CONFERENCE. Meets first and third Thursdays 4 P.M., September to May, Service Memorial Institute, Madison 6.

WISCONSIN RADIOLOGICAL SOCIETY. *Secretary-Treasurer*, Irving I. Cowan, M.D., 425 East Wisconsin Ave., Milwaukee 2.

Puerto Rico

ASOCIACIÓN PUERTORRIQUEÑA DE RADIOLOGÍA. *Secretary*, Jesús Rivera Otero, M.D., Box 3542, Santurce, Puerto Rico.

CANADA

CANADIAN ASSOCIATION OF RADIOLOGISTS. *Honorary Secretary-Treasurer*, Jean Bouchard, M.D. Associate Honorary Secretary-Treasurer, D. L. McRae, M.D. *Central Office*, 1555 Summerhill Ave., Montreal 26, Quebec. Meetings in January and June.

LA SOCIÉTÉ CANADIENNE-FRANÇAISE D'ELECTROLOGIE ET DE RADIOLOGIE MÉDICALES. *General Secretary*, Origène Dufresne, M.D., Institut du Radium, Montreal. Meets third Saturday each month.

CUBA

SOCIEDAD DE RADIOLOGÍA Y FISIOTERAPÍA DE CUBA. Offices in Hospital Mercedes, Havana. Meets monthly.

MEXICO

SOCIEDAD MEXICANA DE RADIOLOGÍA Y FISIOTERAPÍA. *General Secretary*, Dr. Dionisio Pérez Cosío, Marsella 11, México, D. F. Meetings first Monday of each month.

PANAMA

SOCIEDAD RADIOLÓGICA PANAMEÑA. *Secretary-Editor*, Luis Arrieta Sánchez, M.D., Apartado No. 86, Panama, R. de P.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Digestive System

Hernia

The Spleen

The Musculoskeletal System

Gynecology and Obstetrics

The Genito-Urinary System

The Blood Vessels

Technic

Economic Aspects

RADIOTHERAPY

RADIOISOTOPES

EFFECTS OF RADIATION

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Arteriovenous Fistula (Aneurysm) of the Great Cerebral Vein (of Galen) and the Circle of Willis. Report of Two Patients Treated by Ligation. Edwin Boldrey and Earl R. Miller. Arch. Neurol. & Psychiat. **62:** 778–783, December 1949.

Arteriovenous fistula (aneurysm) connecting the great cerebral vein (of Galen) and the circle of Willis is a congenital anomaly, apparently rare and apparently improved by surgical intervention if seen early.

Eight cases of arteriovenous fistula involving the great cerebral vein have been reported, including the 2 presented in this paper. Seven patients were males, and 1 was a female. Four of the cases were discovered in early childhood; 2 in the second decade; 1 in the third decade, and 1 in the fourth decade. The commonest signs were enlargement of the head, dilatation of the veins of the scalp, and cranial bruit. Calcification of the wall of the aneurysm was seen roentgenologically in the 4 older patients.

Vascular engorgement of vessels of the scalp in the presence of a pronounced and persisting bruit is sufficient justification for the study of the cerebral vascular tree. The addition of a calcified shell in the pineal region, visible roentgenologically, associated enlargement of the head, indicating embarrassment of the cerebrospinal fluid flow, or the occurrence of subarachnoid hemorrhage renders an angiographic examination imperative. Angiograms in the authors' cases demonstrated a tremendous bulbous aneurysm of the great cerebral vein, measuring nearly 5 cm. in diameter on the film. There is usually enlargement of the tributaries, including the straight and sagittal sinuses. The posterior communicating and posterior cerebral arteries may also be enlarged. Plain films of the skull may show a crescent of calcification in the wall of the aneurysm.

The treatment usually consists of ligation of the contributing arteries as close to the aneurysm as possible, although in one case the right internal and external carotids were ligated with a satisfactory result.

Four roentgenograms. ALFRED O. MILLER, M.D.
Louisville, Ky.

Arteriographic Study of Effect of Drugs on Intracranial Vessels in Patients with Chronic Headache. A Preliminary Report. Arnold P. Friedman, Emanuel Feiring, Leo M. Davidoff, and H. Houston Merritt. Arch. Neurol. & Psychiat. **62:** 818–821, December 1949.

The authors applied the technic of arteriography to the study of the action of therapeutic agents on the intracranial blood vessels in headache, since it is believed that certain types of headache are caused by aberrations in the caliber of these vessels.

Eight patients who gave a history of chronically recurring headache, and who had been carefully studied in the headache clinic, were selected with their consent to be experimental subjects. Arteriograms were obtained before and after the administration of the drug to be used. Four patients were given histamine intravenously and four others were given ergotamine tartrate intravenously. After the administration of the drug, two arteriograms were taken at stated intervals. In most cases prior to administration of the drug two "normal" arteriograms were obtained at five-minute intervals, to determine the effect of the diodrast.

There was no striking difference in the size of the blood vessels in the two sets of films made to observe the effect of the diodrast. Of the 4 patients receiving histamine, 2 showed rather pronounced dilatation of the blood vessels after the administration of the drug, while 2 showed no significant changes. Of the 4 patients receiving ergotamine tartrate, 2 showed what appeared to be a significant decrease in the size of the blood vessels, while 2 revealed no change.

Four arteriograms; 3 tables.

ALFRED O. MILLER, M.D.
Louisville, Ky.

Communication on Experience with So-called Cisternography. K. Krautzun. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 954–959, October 1949. (In German)

Cisternography proved superior to other contrast investigations in the diagnosis of lesions in the region of the sella turcica, especially in pituitary tumors and acromegaly. The method employed is that of Frimann-Dahl and Ingebrigtsen (Acta radiol. **22:** 592, 1941. Abst. in Radiology **40:** 102, 1943), using lumbar air injection with special positioning of the patient. The injection of 10 to 15 c.c. of air is, as a rule, satisfactory. By this procedure, first the cisterna pontis is filled, next the cisterna interpeduncularis and the cisterna chiasmatis. Occasionally the cisterna laminae terminalis is also visualized.

Three drawings. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Thrombosis of the Internal Carotid Artery. T. G. Illtyd James. Brit. M. J. **2:** 1264–1267, Dec. 3, 1949.

Three cases of thrombosis of the internal carotid artery in the neck were seen by the author in the past two years. Demonstration of the occlusion was by arteriography performed because of suggestive signs of brain tumor twice and once in search of a congenital blood vessel malformation. The etiology was varied: in one case the thrombosis was attributed to arteriosclerosis; one was considered a retrograde thrombosis from a ruptured intracranial aneurysm; the remaining case may have been due to Buerger's disease. All showed occlusion to within a short distance of the origin of the vessel but complete filling of the external carotid and branches. The author suggests that many cases have probably been overlooked and written off as failures in technic because the internal carotid did not fill.

The carotid syndrome of unilateral blindness and contralateral hemiplegia is rare in the cases reported in the literature. Onset of symptoms is usually sudden but may be slow and they may fluctuate in severity, probably because of recanalization and reocclusion.

Prognosis has been poor but it may be improved if the condition is recognized early enough for anticoagulant therapy to be used. Therapy in the past has been directed toward relieving the spasm by sympathectomy or periarterial stripping. Excision of the thrombosed segment has also been done, but since recanalization may take place, this seems unwarranted.

Three roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Foreign Bodies of the Larynx. With Report of an Unusual Case. Ben T. Withers. Ann. Otol., Rhin. & Laryng. **58:** 1085–1092, December 1949.

The author reports a case in which a coin had lodged in both laryngeal ventricles and rested on the vocal cords in a plane perpendicular to the vertical axis of the body. The unusual element of the case was not so much the nature of the foreign body, as the plane at which it became arrested. A foreign body which stops in the larynx usually becomes fixed in the plane of the vertical axis. After elective tracheotomy to insure an airway, the coin was removed from above.

Six roentgenograms. DANIEL WILNER, M.D.
Atlantic City, N. J.

THE CHEST

Surgical Importance of the Anatomical Distribution of the Pulmonary Segments. Edward M. Kent. Am. Rev. Tuberc. **60:** 699–704, December 1949.

The Jackson-Huber classification of the bronchopulmonary segments has been accepted by the American Association for Thoracic Surgery for inclusion in the revised edition of Diagnostic Standards. The terminology and segmental arrangement are illustrated by diagrams and a plea is made for universal acceptance of this classification. The importance of the bronchopulmonary segments in various cases in which segmental resection is indicated is emphasized and several illustrative cases are briefly cited.

Five roentgenograms; 1 photomicrograph; 4 drawings. JOHN H. JUHL, M.D.
University of Wisconsin

A Study of the Apparently Enlarged Pulmonary Conus in Otherwise Normal Subjects. Pierluigi Barbieri and Sirio Lentini. Rassegna clin.-scientifica **25:** 149–153, May 1949. (In Italian)

In 1948 the authors described the technic of visualization of the thymus by means of the injection of 100 to 200 c.c. of gas in the anterior mediastinum. The injected gas collects between the thymus and the heart and dissociates the two shadows in the anteroposterior roentgenogram. This technic has now been applied to the study of patients clinically normal, but showing roentgenographically a marked prominence of the area of the pulmonary conus. In these patients, varying in age from eight to sixteen years, the injection of air in the anterior mediastinum showed that the shadow of the "enlarged pulmonary conus" was in reality the shadow of the left lobe of the thymus. [In the opinion of the abstracter the authors have made a real contribution by interpreting this confusing bulge of the cardiac shadow in otherwise normal subjects.]

Ten roentgenograms. CESARE GIANTURCO, M.D.
Urbana, Ill.

Diagnosis of Pulmonary Emphysema. A. Bogoch and J. E. Walker. Canad. M. A. J. **61:** 611–618, December 1949.

The authors concern themselves only with chronic vesicular "large lung" emphysema. This type of emphysema is distinguished from acute interstitial emphysema, senile ("small lung") emphysema, and compensatory emphysema such as occurs in pneumonia or atelectasis.

Chronic vesicular "large lung" emphysema is characterized by increased volume of the lungs due to abnormal distention of the alveoli, loss of pulmonary elasticity, and formation of blebs and bullae. Its etiology is usually based on conditions which tend to narrow the lumina of the air passages, *e.g.*, bronchial asthma. A permanent reduction in pulmonary tissue such as occurs in diffuse pulmonary fibrosis is followed by emphysematous changes in the remaining functioning lung tissue. Clinically, there are three stages, roughly distinguishable from one another:

(1) Early compensated stage, which may persist for years.

(2) Stage of inadequate compensation, with symptoms and signs of either pulmonary or cardiac insufficiency, or both.

(3) Stage of decompensation, of variable duration but usually lasting a matter of weeks, with death often occurring during an attack of extreme pulmonary insufficiency or intercurrent bronchopneumonia.

Symptoms are usually chronic cough and attacks of asthma, together with a variable degree of exertional dyspnea. Physical findings are variable; the most important are a chest expansion of less than 1 1/2 inches, prolonged expiratory phase, "barrel-chest," hyperresonance to percussion, and reduced diaphragmatic excursion.

Most important of the laboratory findings are a reduced vital capacity (below 75 per cent of normal in individuals under fifty years of age, or below 60 per cent in individuals of any age) and increased residual air. Gaseous exchange in the lungs is also impaired, as would be expected.

Roentgen findings consist usually of increased radiability of the lungs, particularly the bases, flattening of the hemidiaphragms, decreased diaphragmatic mobility, and increased air space between heart and sternum and heart and spine. This last criterion is considered unreliable by the authors, as is also the direction of the ribs and width of the intercostal spaces. Inspiratory and expiratory films are advocated as far superior to the ordinary routine postero-anterior study made in inspiration. The authors consider the demonstration of decreased diaphragmatic excursion as being of more significance than the diaphragmatic level.

Six roentgenograms; 1 chart.
HARVEY J. THOMPSON, M.D.
Jefferson Medical College

Post-traumatic Collapse of the Lungs. V. Knoll. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 931–935, October 1949. (In German)

The suddenness of pulmonary collapse militates against the prevalent conception of bronchial occlusion by a mucous plug, it having been shown experimentally that considerable time is required to produce resorption atelectasis by mechanical obstruction of a bronchus. Nerve and cardiovascular factors probably explain the fulminant and often menacing development of an acute pulmonary collapse. While the mucous plug may provide the "trigger mechanism," the collapse itself is possibly due to a "pulmonary spasm" produced by contraction of the smooth muscle fibers of the lung (and not of the bronchial musculature as previously thought). The fact that the collapse disappears without therapeutic measures also favors this theory. In the retrogression of total collapse, laminated atelectasis may be observed, which suggests that no fundamental difference exists between partial and total collapse.

Two roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Chronic Atelectasis and Pneumonitis of the Middle Lobe. Donald L. Paulson and Robert R. Shaw. J. Thoracic Surg. **18:** 747–757, December 1949.

The authors follow the example of Graham, Burford, and Mayer (Postgrad. Med. **4:** 29, 1948) in describing the "middle lobe syndrome" as a clinical entity. They explain the predilection of the middle lobe as the site of chronic atelectasis and pneumonitis on the basis of the following anatomical peculiarities: First, its drainage is poor. Second, the diameter of its segmental bronchi is small. Third, the lymph nodes of the middle lobe almost completely surround it. The cardinal symptoms of this disease are chronic cough, pain, hemoptysis, dyspnea, and wheeze. Its diagnosis is based upon a careful history, roentgenograms (with emphasis on the right lateral view and complete bronchograms), and bronchoscopy. The most important condition in differential diagnosis is bronchiogenic carcinoma.

The authors' series consists of 32 cases, in 29 of which a right middle lobectomy was performed. Results of surgery were generally satisfactory, with only one death and few complications.

Ten roentgenograms; 4 photomicrographs; 4 tables.

HAROLD O. PETERSON, M.D.
University of Minnesota

Atelectasis due to Anthracotic Lymph Node. H. R. Beck. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 935–937, October 1949. (In German)

Report of the x-ray and necropsy findings in a 68-year old woman with partial atelectasis of the left upper lobe. The changes were due to anthracotic adhesions and mechanical compression caused by a lymph node.

Two roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Fatal Tension Pneumothorax Resulting from Diaphragmatic Rupture in a Patient Receiving Pneumoperitoneum. S. A. Yannitelli, C. E. Woodruff, E. E. Mueller and W. L. Howard. Am. Rev. Tuberc. **60:** 794–800, December 1949.

A case is reported in which a small pneumothorax developed during the course of treatment of pulmonary tuberculosis with pneumoperitoneum. At the time, two small bleb-like areas appeared on the pleural aspect of the diaphragm. Six months later, after pneumoperitoneum had been resumed, a tension pneumothorax developed on the same side. This proved at autopsy to be due to rupture of the diaphragm at the site of the previously noted blebs. It acted like a one-way valve, so that intrapleural pressure was elevated to a level considerably higher than the intraperitoneal pressure had been.

This is believed to be the first fatality due to diaphragmatic rupture and tension pneumothorax associated with therapeutic pneumoperitoneum.

Seven roentgenograms; 2 photographs.

JOHN H. JUHL, M.D.
University of Wisconsin

Chronic Lipid Pneumonia Following Occupational Exposure. J. Paul Proudfit, H. S. Van Ordstrand, and C. W. Miller. Arch. Indust. Hyg. & Occup. Med. **1:** 105–111, January 1950.

A case is reported which is believed to be the first of lipid pneumonia due to occupational exposure on record. A 40-year-old man had worked for seventeen years repairing, cleaning, and lubricating cash registers. As a part of the process he first sprayed the machines with a naphtha solvent and then with a grade-10 liquid petrolatum ("mineral oil") for lubrication. His chief complaints were cough, shortness of breath, and a sense of fatigue. X-ray examination of the chest showed some irregularity of the outline of the diaphragmatic shadows. The heart borders were slightly obscured by underlying and overlying pulmonary changes. A large annular shadow was present opposite the fourth rib anteriorly in the left hilar region, which was interpreted as an old calcified node. Radiating out from the hilus in both right and left mid-lung fields were soft shadows, rather evenly distributed, which for the most part followed the anatomic distribution of the bronchi. The shadows were similar to those produced by lipiodol, especially on a roentgenogram taken several days after injection of the oil.

The patient changed his occupation to one involving no further exposure to liquid petrolatum. When seen after four years, he complained of cough, shortness of breath, and exhaustion following the least exertion. He coughed up moderate amounts of thick yellow sputum, and there was definite clubbing of the fingers and toes. The roentgen changes showed only slight progression.

The diagnosis of chronic lipid pneumonia was established by this lack of significant change, by the relative extensiveness of the roentgen findings as compared with the symptoms, by the history of exposure to "mineral oil," and by the fact that liquid petrolatum was identified in the sputum.

Two roentgenograms.

Diffuse Pulmonary Granulomatosis in Young Women Following Exposure to Beryllium Compounds in the Manufacture of Radio Tubes. Report of Five Cases. Paul Slavin. Am. Rev. Tuberc. **60:** 755–772, December 1949.

Five cases are reported in which diffuse pulmonary changes followed exposure to beryllium compounds in radio tube factories. One case came to autopsy, and spectrographic analyses showed the presence of beryllium in the lungs.

The roentgenographic findings in the lungs were a diffuse miliary nodulation in the early phase, which was gradually replaced by a reticulonodular pattern with larger nodular densities becoming confluent in some areas. The latter change is sometimes superimposed on the miliary nodulations. In none of the cases did massive conglomerations develop, such as are seen in silicosis. Deposition of calcium in the granulomatous nodules was obvious in 2 cases and evidently represents the end phase in their evolution. There was associated cor pulmonale in 3 of the cases.

Fifteen roentgenograms; 4 photomicrographs.

JOHN H. JUHL, M.D.
University of Wisconsin

Pneumoconiosis and Infection. O. A. Sander. J. A. M. A. **141:** 813–817, Nov. 19, 1949.

Seven case records are presented to illustrate different types of combined silicotic and tuberculous lesions. The author concludes, after a survey of over 15,000 workers in dusty trades, that pulmonary tuberculosis is the only infection which appears to be more prevalent in persons with silicosis than in non-silicotic workers. The silicosis apparently affects pre-existing tuberculous

foci and, if the latter are active, tends to keep them so and to prevent healing. Tubercle bacilli are usually not liberated into the bronchial tree for many years, or never, making sanatorium care not only unnecessary but inadvisable unless the bacillus is demonstrated in sputum or gastric contents. Streptomycin is no more effective in halting silico-tuberculosis than in chronic tuberculosis without silicosis. In only a few cases of uncomplicated nodular silicosis has superimposed tuberculosis developed. The author suggests methods of handling inactive silico-tuberculosis.

Twenty-four roentgenograms.

DAVID J. SAYLES, M.D.
University of Michigan

Methods of Tuberculosis Case-Finding in the Community. Mass Chest X-Ray Survey. A Summary of Follow-Up Findings in 200,000 Patients Examined in Erie County, New York. Miller H. Schuck and Wendell R. Ames. New York State J. Med. **49:** 2775–2779, Dec. 1, 1949. **Niagara Falls Mass Chest X-Ray Survey. Community Organization.** Jerauld A. Campbell, William Siegal, and Herman E. Wirth. Ibid., pp. 2779–2782. **Niagara Falls Mass Chest X-Ray Survey. Procedures and Results.** William Siegal, Herman E. Wirth, and Jerauld A. Campbell. Ibid., pp. 2783–2788.

Because the tuberculosis mortality in Erie County was higher than in the rest of New York, a full-time continuous chest x-ray survey program was instituted in 1946. The physician who read the miniature films also read the 14 × 17-inch films on those recalled. In 197,375 films, 632 clinically significant and 597 apparently cured cases of tuberculosis were found. Only 2 per cent of the reportable or clinically significant cases were far advanced. Only 10 per cent were already known to the Health Department.

Five tables.

Preliminary planning and details of the organization of committees and subcommittees for the Niagara Falls (New York) survey are given. This advance work is important, since the aim was to examine every ambulatory person in the city over fifteen years of age. The fact that over 75 per cent of the ideal was attained indicates a very effective campaign. Anyone doing survey work should read the accounts of this undertaking in the original.

In eight weeks, by means of 7 photofluorographic machines, 52,137 persons were examined in a survey of the city. Of these, 481 showed abnormal findings requiring 14 × 17-inch film examination. Only 8 per cent of these were known cases of tuberculosis, and only 2 per cent were far advanced.

As in other surveys, the older age groups were found to have proportionately more tuberculosis than the younger, and yet this age group showed the poorest turn-out for examination.

Three charts; 7 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

A Multiphasic Screening Survey in San Jose. C. Kelly Canelo, Dwight M. Bissell, Herbert Abrams, and Lester Breslow. California Med. **71:** 409–412, December 1949.

Photofluorography for detection of tuberculosis and heart disease, blood studies for syphilis, blood sugar determinations, and urine analysis for the presence of sugar and albumin were combined in a multiphasic survey of 945 employees in four industrial plants in San Jose, Calif. The accuracy of the miniature films in the diagnosis of heart disease was known to be less than that of other methods but was sufficient for survey purposes.

In all, 13 cases of significant disease previously unknown to the patients involved were discovered. Sixteen additional cases, previously known, were disclosed, and, in several, treatment was begun or resumed. The results were significantly better than with customary screening for a single disease. The co-operation achieved between the County Medical Society, the County Tuberculosis Association, the County Health Department, and the State Health Department made the survey possible and far more effective than a study made by any single group.

Four tables.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

Prevalence of Clinically Significant Pulmonary Tuberculosis Among Inmates of New York State Penal Institutions. Julius Katz and Robert E. Plunkett. Am. Rev. Tuberc. **61:** 51–56, January 1950.

A survey of the inmates of penal institutions in New York State by means of chest roentgenograms was undertaken in 1946. An incidence of 1.2 per cent clinically significant tuberculosis was found in males, a figure considerably higher than the prevalence rate in the general population, which is estimated to be 0.3 per cent. The prevalence rate in females was 0.7 per cent. These findings indicate the need for a tuberculosis control program in penal institutions, not only for the care of tuberculous patients but also for the protection of the non-tuberculous inmates and employees, since the incidence found in the present survey is comparable to that previously reported from similar institutions. [For studies in Ohio penal institutions see Absts. in Radiology **51:** 129, 1948; **53:** 598, 1949; **55:** 144, 1950.—Ed.]

Two graphs; 4 tables.

JOHN H. JUHL, M.D.
University of Wisconsin

Miliary Tuberculosis. Report of a Case of Long Duration without Chemotherapy. Harry R. McPhee. Am. Rev. Tuberc. **61:** 138–144, January 1950.

A case of miliary tuberculosis which became temporarily quiescent is reported. The initial symptoms began during an epidemic of "grippe" and were similar to those experienced by the victims of the epidemic. A chest roentgenogram taken three weeks following the onset of the disease revealed fine nodular infiltrations suggestive of miliary tuberculosis. This cleared completely, and the patient became symptom-free; the tentative diagnosis of tuberculosis was never confirmed. A year following the original onset, the patient again became febrile and died two and a half weeks later. Autopsy revealed tuberculous leptomeningitis and caseous foci in kidneys and retrobronchial nodes.

Two roentgenograms.

JOHN H. JUHL, M.D.
University of Wisconsin

Diagnosis of Pneumonia Preceding Tuberculosis. Alvin S. Hartz. Ann. Int. Med. **31:** 1066–1077, December 1949.

A large proportion of the patients admitted to the Tuberculosis Division of the Baltimore (Md.) City

Hospitals for the first time were found to give a history of having been acutely ill with what was diagnosed as pneumonia. For a further study of such cases, 500 charts giving a history of pneumonia were selected at random from the files of the Division. In 71 of the cases, or 14.2 per cent, the time relationship was such as to suggest a possible relationship between the pneumonia and the tuberculous infection. Of the 71 patients, 48 had been treated for pneumonia at home and 23 had been hospitalized. The age, sex, and racial distribution were similar to those of the Tuberculosis Division except for the small number of Negro women in the group, 9 in all.

Three explanations are given as to why pneumonia was diagnosed: (1) The patient had pneumonia without tuberculosis. (2) A pneumonia was superimposed on a tuberculous infection. (3) The findings were misinterpreted as being due to pneumonia when actually due to tuberculosis. The largest number of cases fall in the last group. Several instances were encountered in which a non-tuberculous pneumonia had in all probability accompanied a pulmonary tuberculosis.

A number of factors make it difficult to distinguish clinically between acute non-tuberculous pneumonia and pulmonary tuberculosis: (*a*) The first definite clinical symptoms of tuberculosis may consist of an episode of high fever which subsides in a few days. (*b*) The white count may be elevated in tuberculosis to as high levels as in lobar pneumonia. Approximately one-fourth of patients with far-advanced disease are said to have white counts between 12,000 and 18,000, on admission. (*c*) The tuberculous process may be restricted to a lower lobe, suggesting a non-tuberculous pneumonia. (*d*) In early tuberculosis, prior to caseation, a positive sputum may be difficult to obtain. (*e*) The course of the disease, though usually decisive, may at times prove misleading. While in general non-tuberculous pneumonias resolve within a few weeks and tuberculous infiltrations persist, exceptions to both of these rules occur. Primary atypical pneumonia has been known to give roentgenographic changes for three months. On the other hand, exudative tuberculous lesions may disappear within the same length of time.

Little is found in the literature concerning an antecedent history of pneumonia in tuberculosis. The incidence in this series is far greater than would be anticipated from the reported cases. It must be strongly emphasized that tuberculosis as an etiologic factor should be considered in all acute pulmonary disease. Sputum examinations and follow-up chest films are essential, if error is to be avoided.

Seven roentgenograms; 1 table.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

Factors Influencing the Outcome of Streptomycin Therapy of Pulmonary Tuberculosis. William B. Tucker. Dis. of Chest **16:** 714–743, December 1949.

Of the factors influencing streptomycin therapy in tuberculosis, this report is concerned chiefly with varying dosage schemes and with classifying and reporting on the stage and improvement of the disease as precisely as possible.

The author reviews the co-operative study of the Veterans Administration, Army and Navy, on the effect of streptomycin in tuberculosis, to be reported elsewhere (Am. Rev. Tuberc.), and presents his own study of 86 active cases from the Minneapolis Veterans Administration Hospital, of which 57 were treated according to the Veterans Administration protocol for pulmonary tuberculosis and 29 with less extensive disease were treated primarily for extrapulmonary tuberculosis.

It had been shown by the earlier study that doses of 1 gram a day were therapeutically effective, kept serious toxic symptoms down and, when given for periods of forty-two days or sixty days, reduced the incidence of streptomycin resistance. Longer treatment periods were more effective but increased the development of streptomycin resistance. In the author's series various treatment plans were used.

Disease which was more acute, more recent, less advanced, and less cavernous was found to respond far better to streptomycin than older, more advanced, and chronic disease. Thus the greater the active exudative component in any given case, the better its anticipated response.

All types of the disease showed superior results when collapse therapy, including thoracoplasty, was used in conjunction with streptomycin, especially the mixed cases, *i.e.*, those with acute and chronic components. These results were not affected by variations in dosage schemes as used in this survey.

The response of the cavities is shown to be the chief factor determining the efficacy of streptomycin or any other form of therapy in the treatment of pulmonary tuberculosis.

Roentgen evidence of change in the disease will have far greater value when stress is placed on the degree of change rather than merely noting such change. To this end the following scheme of grading films adopted by the Veterans Administration, Army and Navy study was used by the author with slight modification. 1. Marked improvement. 2. Moderate improvement. 3. Slight improvement. 4. No change. 5. Slight worsening. 6. Moderate worsening. 7. Marked worsening. In conjunction with this, the authors state that determining the frequency of marked x-ray improvement is a better measure of the effect of streptomycin than the simpler determination of any degree of improvement.

Nine roentgenograms; 5 tables.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

A Preliminary Report on the Use of Para-Amino Salicylic Acid in the Treatment of Pulmonary Tuberculosis. Henry C. Sweany, George C. Turner, Meyer Lichtenstein, and Samson Entin. Dis. of Chest **16:** 633–656, December 1949.

A small group of patients, most of whom had far advanced tuberculosis, were given para-amino salicylic acid (P.A.S.) in doses of 3 grams four times daily. Progress of the cases was determined by periodic physical examinations, monthly chest films, and various laboratory studies including sedimentation rate, sputum examination, etc. Of these, the chest films were the most reliable, showing improvement by a clearing of the infiltrates and reduction in the size of the cavities, the walls of which would become thin, then buckle, and often disappear. Improvement was noted in 70 per cent of a group of 40 cases treated with P.A.S., 75 per cent of a group treated with streptomycin, and 30 per cent of a group treated by placebo.

Use of P.A.S. was followed by "marked improvement"

in 4 and "slight improvement" in 2 of 9 cases which had failed to respond to streptomycin. Combined P.A.S. and streptomycin in 7 cases produced improvement in all, the results being about the same as those obtained when streptomycin alone was used.

With respect to symptomatology, cough and fever were diminished in 50 per cent of the patients taking P.A.S., and 70 per cent gained weight.

The undesirable features were minimal: Nausea was a common sign of toxicity, usually was relieved by aluminum hydroxide, and was seldom enough to cause discontinuation of the drug. Vomiting and diarrhea were rare, as were skin eruptions. Resistance to the drug developed in about 10 per cent.

The authors' conclusions are: P.A.S. is of considerable benefit in (exudative) tuberculosis with tension cavities, whereas most cases of the chronic fibroulcerative type are not benefited; over 50 per cent of the cases in which streptomycin failed were benefited by P.A.S.; toxicity is negligible, and the development of resistance to the drug is slight.

In the discussion following the article, Jorgen Lehman of Sweden expressed the opinion that the combined use of streptomycin and P.A.S. reduced or inhibited the development of resistance by the tubercle bacillus to streptomycin. It was also noted, by John S. Packard, that x-ray changes appeared more slowly with P.A.S. than with streptomycin.

Twenty-two roentgenograms; 2 tables.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Early Diagnosis of Bronchogenic Carcinoma. Edward A. Looper and Richard J. Cross. Ann. Otol., Rhin. & Laryng **58:** 1113–1123, December 1949.

About 90 per cent of malignant lesions of the lung are bronchogenic in origin and are of the carcinomatous variety. Sarcoma and tumors of the pleura are extremely rare. Three types of bronchial cancer are recognized microscopically: (1) squamous-cell, (2) undifferentiated or the anaplastic variety, (3) adenocarcinoma. Metastasis is varied and can involve any organ in the body. The sites according to frequency are the lymph nodes, liver, pleura, opposite lung, osseous structures, adrenal glands, kidneys, brain, heart and pericardium, and skin.

The symptoms of lung cancer are varied and depend largely upon the location and cellular characteristics of the tumor. In order of frequency they are as follows: cough, weight loss, fever, dyspnea, hemoptysis, chest pain, gastro-intestinal symptoms, and wheezing.

The roentgenogram is an invaluable aid in diagnosing lung cancer, second only to bronchoscopy. The usual findings are a hilar mass, atelectasis of a lobe, or a suppurative process distal to an obstructing growth. Advanced cases will show mediastinal and tracheal shift, pleural effusion, or hydrothorax. Some difficulty will be met when the findings suggest an acid-fast lesion, lung abscess, or bronchiectasis. Oftentimes a diagnosis of unresolved pneumonia or pneumonitis is made.

Frequently the roentgenogram shows an obstructive emphysema which is indicative of a ball-valve type of bronchial obstruction. This type of lesion is usually discovered early and can best be diagnosed by taking roentgenograms during inspiration and expiration. Bronchography is helpful in demonstrating bronchial obstruction, especially in the secondary bronchi. It also reveals an underlying bronchiectasis or abscess.

Approximately 80 per cent of the cases can be diagnosed by bronchoscopy. The findings usually depend on the size and location of the lesion. Any ulcerations, growths, or stenosis of the bronchus call for careful biopsy of the surrounding tissue. A profuse purulent discharge accompanied by congestion and injection of the bronchus indicates a secondary suppurative process usually distal to the cancer.

Clerf and Herbut (J. A. M. A. **130:** 1006, 1946) reported a series of cases in which, by staining and inspection of bronchial secretions, they could make a diagnosis of carcinoma in 82.4 per cent of the cases compared to 68.4 per cent discovered by biopsy. They further found that in 21 per cent of the cases there was no bronchoscopic evidence of malignancy, but the examination of secretions revealed malignant cells. Secretions are collected routinely at bronchoscopy, smeared and fixed in equal parts of 95 per cent alcohol and ether, and stained by the method of Papanicolaou. It is important that the secretions be smeared and fixed immediately so that the cells will not undergo autolysis.

Bronchial secretions are more reliable than sputum, because the latter is usually highly diluted and mixed with various epithelial cells of the oropharynx. Occasionally a small piece of malignant tissue is found in the sediment, although the bronchoscopic examination is negative.

Another diagnostic method sometimes used is aspiration biopsy. This is mentioned only to be condemned as a blind, inaccurate procedure. Its dangers are far in excess of its value, and it has no place in modern medicine.

Any surgical measures must be undertaken early. Even though bronchoscopic and roentgenologic evidence is lacking, if a carcinoma of the bronchus is suspected, an exploratory thoracotomy should be done.

Five tables.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Silent Phase of Cancer of the Lung. Richard H. Overholt and Ivan C. Schmidt. J.A.M.A. **141:** 817–820, Nov. 19, 1949.

Since the orthodox methods of case finding in carcinoma of the lung depend on lesions extensive enough to produce symptoms, and since the signs are so variable and confusing, delay in definitive treatment is bound to occur. A silent phase of pulmonary cancer exists and is detectable by periodic radiologic screening. The author advocates annual mass survey filming of persons over forty-five years of age, particularly males, and prompt evaluation of survey-found abnormalities. If further filming, cytologic examination of sputum, and bronchoscopy do not explain the pulmonary density on any other basis, surgical exploration is advised.

Eleven roentgenograms; 1 drawing; 2 tables.

DAVID J. SAYLES, M.D.
University of Michigan

Fate of Oil Particles in the Lung and Their Possible Relationship to the Development of Bronchiogenic Carcinoma. L. R. Sante. Am. J. Roentgenol. **62:** 788–796, December 1949.

Highly refined vegetable oils in the lung, such as the commonly used iodized oils, cause no inflammatory reaction. They are eventually completely eliminated by expectoration and by phagocytic action *via* the lymphatics. Animal oils, on the other hand, because

of their high fatty acid content are extremely irritating and may produce an acute or chronic granulomatous lipoid pneumonitis, sometimes with fatal outcome.

Very inert oils, such as mineral oil, remain unchanged in the lung since they cannot be saponified. They eventually are walled off by a low-grade foreign-body reaction, producing the so-called paraffinomas.

The author reports two cases of bronchogenic carcinoma, one occurring in a lipoid pneumonitis and one in a paraffinoma. Both patients were known to have taken mineral oil for years, as a laxative, a tablespoonful or so, just before retiring. Since many hydrocarbons are known to be carcinogenic, it would seem that mineral oil in any form, as a vehicle or for medication, should be used with great caution.

Eleven roentgenograms. ROBERT M. GEIST, M.D.
Cleveland Clinic Foundation

Pulmonary Alveolar Adenomatosis. Sidney J. Shipman, H. Brodie Stephens, and Frederick M. Binkley. Am. Rev. Tuberc. **60:** 788–793, December 1949.

A case of pulmonary adenomatosis is reported in a 51-year-old woman with a history of cough with sputum dating back six years. Roentgenograms showed homogeneous density in the right lower lobe, and lobectomy was performed after other types of treatment failed. The diagnosis was made prior to surgery and was proved correct on microscopic examination of the resected lung. A chest roentgenogram seven months after surgery showed several areas of density in the remaining lung, and cough with mucoid sputum had recurred.

Theories of etiology and pathogenesis are briefly discussed; and the resemblance of the condition to the infectious disease of sheep, jaagsiekte, is noted. Roentgen findings were progressive, with density resembling pneumonic consolidation in the right lower lobe.

Four roentgenograms; 4 photomicrographs.

[Two papers on pulmonary adenomatosis appear in this issue of Radiology, pp. 669 and 681.—Ed.]

JOHN H. JUHL, M.D.
University of Wisconsin

The Pancoast Tumor as a Penetrating Form of Bronchial Carcinoma. Heinrich Eschbach. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 927–931, October 1949. (In German)

The author emphasizes two characteristics of the so-called Pancoast tumor (pulmonary sulcus tumor): first, the tendency to penetrate to the periphery and so to destroy the thoracic cage and the vertebrae; second, the relatively early cachexia. As, in almost half of his cases, apical pleural adhesions were present, it is not improbable that these adhesions play a part in directing the extension of the tumor toward the periphery, thus influencing its penetration or "escape" features.

Six illustrations, including 3 roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Perforation of Both Main Stem Bronchi by a Large Broncholith Located in the Subcarinal Region. Uneventful Recovery Following Its Endoscopic Removal. Arthur Q. Penta. Ann. Otol., Rhin. & Laryng. **58:** 1135–1140, December 1949.

The true definition of the term broncholithiasis is the formation of a calculus within the bronchial lumen. Clinical and postmortem findings, however, clearly indicate that the majority of calculi are extrabronchial and develop as a result of tuberculosis of the lymph nodes which accompany the pulmonary vessels and the ramifications of the bronchi. The peribronchial and perivascular location of these calculi may lead to perforation of a bronchus or erosion of a vessel. The clinical symptoms resulting are chiefly those of bronchial occlusion and may suggest a foreign body, intrabronchial neoplasm, endobronchial tuberculosis, chronic bronchitis, or bronchial asthma.

The diagnosis of broncholithiasis is rarely made except by bronchoscopy. If the history reveals that calcareous material has been coughed up, this is of significance. X-ray studies of the chest do not always permit a positive diagnosis, since many of the calculi are located in the hilar and subcarinal regions, where they are overshadowed by the large vascular structures in this area. Then, too, broncholiths which have not undergone complete calcareous formation may show a decreased opacity for x-ray interpretation. Sectional radiography may reveal the presence of calculi which have failed to appear in the ordinary roentgenograms. If calcific masses are present in the chest roentgenograms, no time should be lost in submitting the patient to a bronchoscopic examination.

The author reports the case of a 45-year-old white woman who had been treated for the past ten years for intractable bronchial asthma associated with paroxysmal attacks of coughing and recurrent hemoptysis. Numerous chest films were suggestive of bronchial asthma. Endoscopy showed both main stem bronchi to be almost completely occluded close to the carinal bifurcation by a granulomatous-like mass of tissue. This was removed and proved to be a broncholith measuring 1.75 × 1.5 cm.

The author believes that no patient, particularly in the adult group, should be treated for bronchial asthma without a diagnostic bronchoscopy.

Three roentgenograms; 1 drawing.

DANIEL WILNER, M.D.
Atlantic City, N. J.

Role of Angiocardiography and Venography in Mediastinal and Paramediastinal Lesions. Osler A. Abbott, William A. Hopkins, and Ted F. Leigh. J. Thoracic Surg. **18:** 869–891, December 1949.

The authors present 21 cases which demonstrate the value of angiocardiography or venography, or both, in the diagnosis of mediastinal tumors. They find angiocardiography useful in distinguishing vascular from non-vascular lesions, on the one hand, and in contributing additional information concerning the nature and extent of non-vascular lesions on the other. As far as the area of the mediastinum to be investigated is concerned, the method is especially indicated in the middle and superior portions.

The authors comment also on their experience with angiocardiography in the work-up of cases of probable pulmonary carcinoma. They have been able to demonstrate abnormalities of the pulmonary arterial system in many of these. The method was successful where both bronchoscopy and bronchography failed to demonstrate the lesion.

Fifty roentgenograms.

HAROLD O. PETERSON, M.D.
University of Minnesota

Chronic Mediastinitis as Sequela of Primary Paraffin-oil Plombage with Stenosis of Esophagus and Trachea. L. Diethelm. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 941–944, October 1949. (In German)

Chronic mediastinitis with marked shrinking of the mediastinum and with extensive esophageal and tracheal stenosis was observed radiologically in two patients in whom collapsed lung cavities had been filled with paraffin oil seven years and two years earlier, respectively, for pulmonary tuberculosis.

Five roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Infrapulmonary Pleural Effusion Simulating Elevation of the Diaphragm. Emil Rothstein and Francis B. Landis. Am. J. Med. **8:** 46–52, January 1950.

Twelve cases of infrapulmonary effusion simulating elevation of the diaphragm are presented. Six occurred during the course of pulmonary tuberculosis. Two were of unknown etiology, one was due to bronchogenic carcinoma, one was cardiac, one was a postpneumonic empyema, and one was the result of metastatic hypernephroma.

Pleural effusions are most commonly demonstrated as a curvilinear density, with the concavity downward and outward, extending up along the axillary border of the chest. The reason for a convex upper border in a few cases never has been explained adequately. The nature of this shadow may be suspected when there is a separation of the air-containing fundus of the stomach from the lower margin of the lung. That this shadow is due to fluid may be indicated by its shift with changes in the position of the patient. Supine and lateral decubitus films are useful in this respect. If the effusion is encapsulated, it may be necessary to perform a diagnostic pneumoperitoneum to demonstrate that the density is above the diaphragm.

Differentiation must be made from elevation of the diaphragm due to phrenic paralysis, re-expanded pneumothorax, subphrenic disorder, eventration, and recent acute inflammatory subdiaphragmatic disease. Also to be distinguished are subphrenic abscess, hepatomegaly, and diaphragmatic hernia.

Ten roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

Angiocardiography and Aortography in the Diagnosis of Congenital Cardiovascular Lesions. Thomas H. Burford, Merl J. Carson, and Wendell G. Scott. J. Thoracic Surg. **18:** 860–868, December 1949.

This is a rather short article stressing the value of angiocardiography and aortography in certain congenital lesions, especially of borderline nature. Since developing the tautograph, a new automatized radiographic equipment (Scott and Moore: Am. J. Roentgenol. **62:** 33, 1949. Abst. in Radiology **54:** 918, 1950), and an improved modification called the rapidograph (Radiology **53:** 846, 1949), the authors have done 86 visualizations, of which 63 were intravenous angiocardiograms and 23 retrograde aortograms. The latter are particularly valuable when it is desired to study the aorta and its immediate branches, and the authors state that they have thus gained decisive information in cases of coarctation, patent ductus, aortic arch anomalies, and aneurysm.

Nine roentgenograms; 2 photographs.

HAROLD O. PETERSON, M.D.
University of Minnesota

Angiocardiography and Cardiac Catheterization as Aids in the Diagnosis of Congenital Heart Disease. Harry F. Zinsser, Jr., and Richard L. Kendrick. Pennsylvania M. J. **52:** 1665–1670, December 1949.

Newer surgical methods recently developed for the correction of certain cardiac lesions have necessitated accurate preoperative diagnosis that is not always possible by standard procedures. One of the newer methods is angiocardiography, in which a viscous contrast solution is rapidly introduced into the venous system and exposures are made of the heart in rapid succession, with the aid of a special film changer. Another method is cardiac catheterization, whereby a catheter is introduced through a vein directly into the heart; blood pressures are taken and blood samples are drawn off.

All patients are first thoroughly studied by the usual methods, which include a history, physical examination, electrocardiography, chest roentgenography, fluoroscopy with barium, and studies of the circulation time. When these procedures fail to reveal the diagnosis, one of the two methods mentioned above is used.

Congenital cardiac lesions can be placed in three groups: (1) those with no mixing of oxygenated and unoxygenated blood, (2) those with left-to-right shunts, (3) those with cyanosis.

Group 1: Anomalies with no shunting of blood include coarctation of the aorta and right-sided aortic arch, both of which can usually be diagnosed by ordinary methods. In coarctation, however, angiocardiography may show the constriction and give the surgeon a better landmark. Occasionally it is useful in determining the course of a right-sided aorta.

Group 2: In general, angiocardiography is of little use in patients with left-to-right shunts.

Group 3: In cases of the tetralogy of Fallot which cannot be diagnosed clinically, the authors prefer to try angiocardiography first, following this by catheterization if necessary. On angiocardiography, the filling of the aorta simultaneously with the right-sided structures, and before the left ventricle is opacified, proves the presence of an overriding aorta and ventricular septal defect. The demonstration of pulmonary stenosis with reduced pulmonary artery flow, however, is the crucial point. If this is not evident on the angiocardiogram, catheterization to obtain pressure readings may supply the necessary data. The right ventricle will show a high systolic pressure, with a sudden sharp fall if the catheter passes beyond the point of stenosis into the pulmonary artery.

In the Eisenmenger complex the angiocardiographic findings are similar to those in the tetralogy of Fallot except that the right outflow tract is normal and there is no pulmonary stenosis. On catheterization the systolic pressure reading does not fall below the ventricular reading.

Four roentgenograms; 7 tables.

JOSEPH T. DANZER, M.D.
Oil City, Penna.

Coarctation of the Aorta. E. R. Hayes and H. M. Stauffer. Am. J. Med. **7:** 835–837, December 1949.

A case of coarctation of the aorta, diagnosed in a 72-year-old man by the clinical and x-ray findings, is re-

ported. This patient lived an active life despite signs of right and left ventricular failure. He had had significantly elevated blood pressure for fifty years, but according to the ophthalmologist the changes in the vessels of the optic fundi were "within normal limits for the patient's age." This would seem to lend support to the theory that the vascular changes in the optic fundi as seen in essential hypertension are the product of more than the elevated blood pressure.

Two of the common clinical findings in coarctation were not demonstrable, namely, the basal systolic murmur and absence of femoral pulsations, yet the findings dependent upon collateral circulation were very apparent. It is possible that the low position of the aortic arch in this patient might explain the absence of the typical basal systolic murmur.

Rib notching was quite extensive and pronounced. A shadow suggesting a prominent aortic knob in the presence of definite clinical and roentgen signs of coarctation is of interest, since one of the usually helpful roentgen signs is the inconspicuousness of the aortic knob. Visualization of the shadow of the left border of the descending aorta well within the heart border was taken as evidence that the upper vascular projection was actually the dilated proximal portion of the left subclavian artery.

The patient responded well to ordinary treatment for congestive failure.

Two roentgenograms.

Coarctation of the Aorta at Unusual Sites. Report of Two Cases with Angiocardiographic and Operative Findings. Henry T. Bahnson, Robert N. Cooley, and Robert D. Sloan. Am. Heart J. **38:** 905–913, December 1949.

Two cases are presented of coarctation of the aorta distal to the usual site at the level of the ductus arteriosus; one was mid-thoracic and one below the renal arteries. In the thoracic case, the narrowing was diffuse, with irregular thickening of the aortic wall suggestive of a low-grade chromic inflammatory process. The abdominal lesion was sharply localized, with no suggestion of inflammation. Ten other cases in which there was an aortic stenosis below the region of the ductus arteriosus were found in a survey of the literature, and these are briefly reviewed.

While clinical examination can make the diagnosis of the presence of coarctation, there is no way to determine the site and extent of the narrowing other than angiocardiography. The authors recommend the procedure in any case where surgery is to be attempted.

Two angiograms; 1 drawing.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

A Study of the Cardiac Frontal Area in Patients with Arteriovenous Fistulas. Harris B. Shumacker, Jr., and Nicholas M. Stahl. Surgery **26:** 928–944, December 1949.

The authors present a detailed analysis of studies of heart size before and after operative obliteration of arteriovenous fistulae in 185 soldiers. Most of the fistulae were the result of battle injuries. Teleroentgenograms were made in all patients, generally both before and after operation. The cardiac silhouette was studied and sizes were calculated according to the method of Ungerleider and Gubner (Am. Heart J. **24:** 494, 1942. Abst. in Radiology **40:** 528, 1943). Extensive tables and charts record the results in detail.

Cardiac enlargement was noted in a large number (about 50 per cent) of the patients with peripheral arteriovenous fistulae of relatively short duration. A few had symptoms of cardiac strain, but none had evidence of cardiac failure. The incidence and degree of cardiac enlargement and the rapidity with which enlargement took place were less in those patients with fistulae of the head, neck, and upper extremities. The size of the artery involved, the size and age of the fistula, and the magnitude of the pulse and blood pressure response to temporary occlusion of the fistula could be correlated with the tendency to early development of cardiac enlargement.

Nearly 60 per cent of the patients showed some reduction in heart size following operative obliteration of the fistula.

Eleven tables, six graphs, and a bibliography accompany the article.

J. B. SCRUGGS, M.D.
University of Arkansas

Differential Diagnosis Between Pericardial Effusion and Cardiac Dilatation. Michele Sossai. Radiol. med. (Milan) **35:** 979–984, December 1949. (In Italian)

The author stresses the importance of studying the angle formed between the main bronchi in differential diagnosis of pericarditis with effusion and cardiac enlargement. In cases of pericarditis the angle formed between the main bronchi is about normal; it will be widened by an enlarged heart.

Eight roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Vascularization of the Aorta. II. A Comparative Study of the Aortic Vascularization of Several Species in Health and Disease. J. Schlichter and R. Harris. Am. J. M. Sc. **218:** 610–615, December 1949.

An investigation was made, on specimens obtained postmortem, of the vascularization of the aorta in the dog, man, chicken, and rabbit. An opaque suspension was injected into the vasa vasorum of the aorta, and roentgenographic studies were carried out.

Vascularity was found to be greatest in the dog and progressively less in the man, chicken, and rabbit. This affords experimental workers a logical guide in selecting the proper species for work on degenerative diseases of the aorta. Details of the technics used are given.

Four roentgenograms; 1 table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

An Improved Method of Visualizing the Coronary Arteries at Post Mortem. R. W. Scott, A. F. Young, H. A. Zimmerman, and Ileen Kroh. Am. Heart J. **38:** 881–888, December 1949.

A technic of dissection of the heart and injection of the coronary arteries with opaque medium is presented which allows the heart to be unrolled so that the coronary arterial circulation may be studied in one plane. The dissection is modified from Schlesinger's method (Am. Heart J. **15:** 528, 1938) to preserve the valves of the heart intact, without distortion.

Barium sulfate suspended in a liquid latex solution along with dyes is the opaque medium. It is injected by the method of Salans and Tweed (Am. Heart J. **33:** 477, 1947) with some simplification by the authors.

One normal and one abnormal specimen are illustrated, showing the coronary circulation in very good detail. From the x-ray film it can easily be determined where specimens should be taken for microscopic study. The colors of the dyes used can still be seen on the microscopic slides.

Two roentgenograms; 4 photographs.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Relationship of the Roentgenographic Appearance of the Pulmonary Artery to Pulmonary Hemodynamics. R. F. Healey, J. W. Dow, M. C. Sosman, and L. Dexter. Am. J. Roentgenol. **62:** 777–787, December 1949.

The authors present an excellent analysis of roentgenographic pulmonary artery changes in intrinsic heart disease based on catheterization studies.

1. Abnormal increases in resting flow of moderate size (less than 7L/min./M^2) through the pulmonary artery rarely produce a recognizable change.

2. Abnormal increases in resting flow of large size (greater than 7L/min./M^2) through the pulmonary artery usually produce changes which are roughly proportional to the size of the flow. These changes consist of an increase in the size and hyperactivity of the artery and branches.

3. Abnormal increases in pressure in the pulmonary artery at rest result in changes which to the authors are indistinguishable from those of increased flow.

4. The combination of an abnormal increase in both pressure and flow at rest produced changes that resemble those of either pressure or flow alone.

5. Pulmonic stenosis with normal pulmonary arterial flow and pressure is usually characterized by a post-stenotic dilatation of the artery which in the cases studied was localized to the main pulmonary artery and did not include the hilar or the intrapulmonary branches.

6. Reduced flow beyond a pulmonic stenosis, seen best in the tetralogy of Fallot, often causes no recognizable changes in the pulmonary artery. There may, however, be significant dilatation or reduction in the size of the main artery.

Twelve roentgenograms; 5 tables.

E. HAMPTON BRYSON, M.D.
Cleveland Clinic Foundation

Calcification of the Annulus Fibrosus. Stewart F. Alexander and Samuel Alexander. J. M. Soc. New Jersey **46:** 562–564, December 1949.

Report is made of a case of advanced calcification of the annulus fibrosus. While this is essentially a benign and asymptomatic finding, the importance of differentiation from calcification primarily of the mitral valve is pointed out. It is believed that calcifications within the structure of the heart would be more frequently demonstrated if they were considered and sought.

Three roentgenograms.

THE DIGESTIVE SYSTEM

A Study of the Effect of Certain Drugs on Curling of the Esophagus. A Preliminary Report. A. Sheinmel, C. A. Priviteri, and M. H. Poppel. Am. J. Roentgenol. **62:** 807–813, December 1949.

As described by the authors, curling of the esophagus is indicative of multiple, irregular, alternating, localized contractions and dilatations. These are created by in-co-ordinated multiple segmental muscle spasms which do not necessarily encircle the esophagus but may be located anteriorly, laterally, or even posteriorly. The condition is usually asymptomatic, but in 2 of the authors' 15 cases it was accompanied by pain. The condition is found most often in males past middle age. It is regarded as uncommon but not rare.

During fluoroscopy, the spasms will best be seen to develop when the esophagus is full. The contractions are more pronounced in the horizontal position. They are stationary and do not progress upward or downward. They may be evanescent or quite persistent and are independent of each other as regards extent and phase. A peristaltic wave may partially or completely eradicate the curling.

The etiology is unknown, but the authors believe the condition is due to intrinsic muscle spasm. In support of this belief, they studied the effects of various smooth muscle antispasmodics on 2 cases. Of the drugs tried, amyl nitrite produced complete but temporary relief, benzedrine sulfate, 5 mg. every four hours for thirty-six hours, produced complete relief of long duration, while atropine and belladonna were less effective.

Fourteen roentgenograms.

RICHARD L. MASON, M.D.
Cleveland Clinic Foundation

Absorption of Barium Sulfate and Non-Absorption of Zirconium Dioxide from the Gastrointestinal Tract. Lathan A. Crandall, Jr. Gastroenterology **13:** 512–526, December 1949.

Alvarez' statement, in his *Introduction to Gastroenterology* (New York, Paul B. Hoeber, Inc., 1940), that enough barium sulfate is absorbed through the intestine to act as a stimulus to its activity, prompted the study reported here. Barium sulfate containing radioactive Ba^{140} was fed to rats, and because the absorption of definite amounts of barium was revealed by examination of the ashed tissues, the experiment was repeated using spectrographic determination of barium in animals which had received ordinary barium sulfate. As a control, zirconium dioxide, which is believed to be completely insoluble, was employed, with Zr^{95} as the tracer element. These control studies showed that the apparent absorption of barium could not be attributed to faulty technic, since no absorption of zirconium was found. In addition they threw light on some properties of zirconium oxide which suggest that it may have particular virtues as a contrast medium for gastrointestinal roentgenology. It is more expensive than barium sulfate, but it lacks toxicity, has a higher coefficient of absorption of roentgen rays at wave lengths employed in diagnostic radiology, and a reduced amount of scattering as compared with barium sulfate as a contrast medium.

Three illustrations; 7 tables.

JAMES C. NEERING, M.D.
Cleveland Clinic Foundation

Effect of Atropine on the Physiology of the Pylorus. Giuseppe Deriu. Radiol. med. (Milan) **35:** 939–948, December 1949. (In Italian)

The author uses 1 mg. of atropine injected hypodermically to relieve pyloric spasm and increase gastric peristalsis during radiologic examination of the stomach.

He finds this method preferable to the injection of morphine because of the absence of any side reactions.

Forty-one roentgenograms.

CESARE GIANTURCO, M.D.
Urbana, Ill.

Configuration and Relations of the Stomach During Gastroscopy. Eddy D. Palmer and Edward L. Rea. Gastroenterology **14:** 131–146, January 1950.

The configuration of the air-filled stomach as seen during gastroscopy differs markedly from the configuration of the barium-filled stomach seen during x-ray examination and from the conventionally illustrated stomach. The air-filled stomach tends to flow high in the abdomen, the pressure of the air is exerted equally over the inner surface of the organ, the stomach is usually more distended than when filled with barium, and the gastric tone is reduced.

In order to elucidate factors of gastric configuration and relation to other organs as they exist during gastroscopy, the authors studied 13 white males with upper gastro-intestinal complaints by making roentgenograms in two projections during actual gastroscopy with the stomach inflated with air. One patient was studied with Levine tube insufflation only, a previous gastroscopic examination having been negative.

The authors discuss and illustrate the effect of body position on the position of the inflated stomach, the changes in configuration produced by the gastroscope, and the progressive anterior displacement of the antrum and pylorus as insufflated air passes into the small bowel. The importance of the degree of mobility of the first part of the duodenum in controlling the ability of the examiner to visualize the pylorus is brought out, and in this respect the patients could easily be classified into two groups. Observations were made on other blind areas along the medial wall of the supracardiac portion of the fundus and at the end of the axis of the gastroscope. In 1 case studied, a cascade stomach had been demonstrated by radiologic examination, and in another prolapse of antral mucosa through the pylorus was demonstrable roentgenographically. Neither of these findings was apparent in the air-inflated stomach.

Twelve roentgenograms, with accompanying drawings, and 1 drawing to show the relationships of the inflated stomach during gastroscopy.

DONALD F. MAURITSON, M.D.
Cleveland City Hospital

Importance of the Configuration of the Stomach for the Occurrence of Ulceration and other Diseases of the Stomach and Duodenum. Alfred Vogt. Forstchr. a. d. Geb. d. Röntgenstrahlen **71:** 861–896, October 1949. (In German)

The author's survey is based on the observation of 6,926 patients who underwent gastro-intestinal x-ray examination at the Tübingen University Clinics from 1937 to 1943. In 40.5 per cent of this number pathologic changes were diagnosed; in another 13 per cent hypertrophy of the gastric mucosa was reported.

Four types of stomach were differentiated: the "fish-hook" type, the "relaxed or atonic fish-hook" type, the "steer-horn" type, and the "cascade" type. The occurrence of peptic ulcer varies considerably in the different types and leads the author to the conclusion that the form of the stomach plays a major part in the pathogenesis of gastric lesions. Gastric ulcer is three times as frequent in men with cascade stomach than in patients without cascade stomach. The relaxed fish-hook type predisposes considerably more to ulceration than the steer-horn type. The plain fish-hook type is about equally distributed among patients with ulcer and those without. Of 100 patients with cascade stomach, 47.6 per cent had gastric ulcers; this ratio dropped to 38.8 per cent in patients with stomachs of the relaxed fish-hook type, 28.3 per cent in the plain fish-hook type, and 18.5 per cent in the steer-horn type. In general, the ulcer figures in men were 3 to 12 per cent higher than in women.

No relation between the type of stomach and the acidity figures could be established. Only in steer-horn type stomachs with duodenal ulcer, an extremely high percentage of patients (97 per cent) showed constantly high acidity values.

The most frequent location of ulcer was 3 to 5 cm. above the angulus in fish-hook types, in the angulus in steer-horn types, and at the site of the cascade curvature in cascade stomachs.

Twenty-two figures, including 16 roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Contribution to the Differential Diagnosis of Niches at the Greater Curvature of the Stomach. Th. Hornykiewytsch. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 906–911, October 1949. (In German)

Of three niches observed at the greater curvature of the stomach, two proved malignant, while one was probably due to benign ulcer. The author stresses the fact that, at best, the radiologist may be able to make a definite diagnosis in plain diverticula or in malignant processes only. In all cases of niches over the larger curvature, exploratory laparotomy or at least follow-up examination after an ulcer diet (four to five weeks) is advised.

Seven roentgenograms. ERNST A. SCHMIDT, M.D.
Denver, Colo.

Case of Chronic Ulcer of the Greater Curvature of the Stomach Simulating Carcinoma. Antonio E. Mendes Ferreira and Ayres de Sousa. Gaz. méd. Portuguesa **3:** 111–114, 1950. (In Portuguese).

The authors add another case of chronic ulcer of the greater curvature of the stomach to the comparatively small number reported in the literature.

Three roentgenograms; 1 photomicrograph.

Neurofibroma of the Stomach. Benjamin M. Banks. Gastroenterology **14:** 158–167, January 1950.

Though rare, benign tumors of the stomach are of considerable clinical significance, since errors in diagnosis may lead to needless radical operations or to unwarranted withholding of necessary surgery. Dangerous complications such as strangulation, pyloric obstruction, and massive hemorrhage may occur suddenly and without warning.

The author reports 3 cases of solitary neurofibroma of the stomach and discusses the manifestations which may be helpful in the recognition of these tumors. The three patients demonstrated among them every one of the cardinal features which may characterize the onset and subsequent course of the disease.

The tumors in most instances are derived from the sympathetic fibers of the plexuses of Auerbach or

Meissner. Commonly the tumor grows outward from the stomach and projects into the peritoneal cavity. Less often it grows inward and is represented in the stomach as a filling defect. Attention is called to the necessity of special staining to demonstrate the specific histopathologic features. Without stains, an erroneous diagnosis of leiomyoma may be made.

There is considerable variation in the clinical manifestations of gastric neurofibroma. The coexistence of generalized manifestations of von Recklinghausen's disease of the skin, especially when associated with an hereditary history, low mentality, or arthritis deformans, should draw attention to the lesion as a likely explanation for an obscure gastro-intestinal disorder.

The radiologic findings are not specific, but in general the mass, if seen, is rounded, or occasionally lobulated, with smooth, sharp edges. If ulceration is present, it is usually superficial. The rugae are not appreciably altered, and the gastric wall remains pliable. Peristalsis is not likely to be interrupted, and there is no incisura or other evidence of spasm. Unless the tumor is of good size, however, the foregoing characteristics may be masked and the growth overlooked completely unless three details of technic are observed; the use of *compression, underfilling of the stomach with barium,* and *over-penetration* in the taking of the roentgenograms. In the last analysis, the experience and interest of the fluoroscopist will determine the frequency with which such tumors are discovered.

Surgery is the treatment of choice, and recurrence is infrequent.

Three illustrations, including 1 roentgenogram.

RICHARD A. ELMER, M.D.
Cleveland City Hospital

Hemangioendothelioma of the Stomach. Felipe Basch. Prensa méd. argent. **36:** 2548–2551, Dec. 2, 1949. (In Spanish)

The literature records very few cases of gastric hemangioendothelioma. Stout published (Ann. Surg. **118:** 445–464, 1943) a study of 18 cases: 3 of the mammary gland, 2 of the liver, 2 of the bone, 1 of the pleura, 1 of the uterus, 2 of striate muscle, 1 of the orbit, and 6 of the skin and subcutaneous cellular tissues. No case of a gastric lesion has been cited thus far.

The present report—the first on this type of tumor in the Argentine literature—concerns a woman of 41 years who underwent operation for a subserous movable tumor, the size of a pigeon's egg, on the anterior wall of the stomach, in the vicinity of the pylorus. The resected tissue was histologically diagnosed as a hemangioendothelioma of the gastric wall.

Eight illustrations, including 4 roentgenograms.

JAMES T. CASE, M.D.
Chicago, Ill.

Contribution to the Radiologic Differential Diagnosis of Gastric Polyposis. Rudolf Altmann. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 896–900, October 1949. (In German)

Report of a case in which apparently typical gastric polyps were simulated by constant hypertrophy of the gastric mucosa. Supplementing the x-ray examination by gastroscopy is recommended to exclude this possibility.

Two roentgenograms.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Prolapse of Redundant Gastric Mucosa through the Pyloric Canal into the Duodenum. Isaac Hall Manning, Jr., and J. U. Gunter. Am. J. Path. **26:** 57–73, January 1950.

It is believed that prolapse of redundant gastric mucosa through the pylorus into the duodenum is more common than is generally recognized, although not necessarily of clinical significance. Sixteen cases were reported by Manning and Highsmith (Gastroenterology **10:** 643, 1948. Abst. in Radiology **52:** 451, 1949). Manning and Gunter now present 6 cases in which autopsy studies were made. In no instance was the prolapse of the mucosa responsible for death. In 4 cases the diagnosis was made roentgenologically prior to death. In 1 case no films were obtained; and in the other prolapse was not recognized roentgenologically.

Pathologic examination revealed a hypertrophic gastritis in 5 cases and atrophic gastritis in 1 case. In 4 cases the submucosa was unusually loose, so that the mucosa slid easily over the muscularis. In one case the redundant mucosa appeared as a tongue-like, polypoid fold protruding through the pylorus, with no unusual looseness of the submucosa. In the other case a hypertrophied fold of gastric mucosa was forced into the duodenum by a hypertrophied pyloric muscle. The pyloric muscle was thickened and the pyloric canal narrowed in 4 cases. The muscularis mucosa was thickened in 3 cases. With the exception of a single case, the antral rugae were oriented in an irregular manner. In 1 case the mucosa was atrophic, with complete loss of rugal folds.

Four plates, with roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California

A New Diagnostic Criterion for Gastric Syphilis. Herbert Berger. Gastroenterology **14:** 147–151, January 1950.

The appearance of several patients with gastric disease appearing concomitantly with tertiary syphilis has brought forth the question of syphilis as an etiologic factor in the production of gastro-enteric disease. It may manifest itself as a specific intragastric lesion or there may be gastric complaints due to syphilis of the central nervous system.

Two case reports are presented. Both patients had gastric symptoms, positive blood Wassermann reactions, and radiographic defects of the stomach. After intensive penicillin therapy, both showed a marked improvement with reference to the gastric complaints.

Certain criteria are necessary for a clinical diagnosis of gastric syphilis, and the author hopes to have added another, namely the response of the disease to penicillin. Essential to the diagnosis are an untreated tertiary syphilis, a radiographic defect, gastric symptoms, inability to alleviate symptoms or bring about radiographic improvement by usual methods of therapy without antisyphilitic treatment, and symptomatic relief and/or radiographic improvement after intensive specific therapy. The intensive treatment given the author's patients has been by the rapid method with penicillin. The advantages of this over arsenicals and bismuth is that the radiologic changes may occur within three weeks, thereby causing no significant delay if the patient eventually requires an operation.

Two roentgenograms.

NELSON E. KLAMM, M.D.
Cleveland City Hospital

Contribution to the Diagnosis to Gastric Volvulus. Wolf S. Reichel. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 900–905, October 1949. (In German)

Five cases of gastric volvulus diagnosed radiologically are described. In 2 cases with spontaneous reversibility the process of production and reduction of the volvulus could be studied fluoroscopically. In 3 cases an irreversible total mesentero-axial volvulus was present. Primary diaphragmatic disease combined with endogenous or exogenous factors (meteorism, tumor of the spleen, intra-abdominal pressure variations) is considered a predisposing element. Clinically the disease lacks pathognomonic symptoms and frequently suggests the syndrome of incomplete pyloric stenosis. Radiologic examination is indispensable in the final diagnosis.

Four roentgenograms, 1 drawing.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Effect of a Functional Load on the Motility of the Small Intestine. M. Fóti. Acta radiol. et cancerol. bohemoslov. **4:** 142–151, Dec. 30, 1949. (In French)

By mixing 40 gm. of butter with 300 gm. of opaque substance, a functional load is placed on the small intestine, and a more sensitive examination of jejunoileal transit time is obtained. Under normal conditions the test meal reaches the ileocecal valve in two hours. Hypermotility and hypomotility are assessed by the extension of the meal past the valve or failure to reach it in the alloted time. Disturbance of the gastro-ileal reflex is increased by the load. In biliary tract disease, motility is increased except when obturating stones are present. It is reduced in gastric or duodenal ulcer, hypersecretory gastritis, appendicitis, neurasthenia, enteroptosis, and in the menopausal syndrome.

These conclusions are based on 600 examinations.

CHARLES NICE, M.D.
University of Minnesota

Carcinoma of the Small Bowel: Report of a Case. C. F. G. Brown and L. A. Nalefski. Gastroenterology **14:** 168–181, January 1950.

The literature is reviewed and a case of annular glandular carcinoma of the small bowel proved at autopsy is presented.

Approximately 300 proved cases of carcinoma of the small bowel have been reported to date. Johnson (Brit. J. Surg. **9:** 422, 1922) has classified the tumors as (*a*) stenosing, (*b*) polypoid, (*c*) ulcerative, and (*d*) colloid. Ewing divided them into three groups: (*a*) part of a local or a general intestinal polyposis extending from the colon; (*b*) embryonal or carcinoid rests, usually in the ileum or jejunum; (*c*) adenocarcinomata usually arising from intestinal polyp. The majority are of the latter type. Metastasis takes place early. The tumors are more frequent in men than in women.

Symptoms are, in general, weakness, early fatigability, weight loss, and anemia, with evidences of obstruction.

Roentgen diagnosis of small bowel tumors is exacting and time-consuming. The methods include (1) motility examination with oral administration of barium, (2) injection of barium through an intestinal tube, (3) barium enema, with reflux of the solution into the terminal ileum. Roentgen criteria for diagnosis are narrowing, filling defect, compensatory widening proximal to the lesion, coiling and distention, as well as alteration or obliteration of the mucosal pattern, obstruction, and ulceration.

Two illustrations; 2 tables. SHOZO IBA, M.D.
Cleveland City Hospital

Lipomas of the Gastrointestinal Tract. William L. Palazzo. Am. J. Roentgenol. **62:** 823–830, December 1949.

The pertinent clinical and roentgenologic features of 36 cases of lipoma of the gastro-intestinal tract are presented. The majority of the cases were discovered incidentally at autopsy.

Thirteen cases gave rise to definite symptoms during life, consisting of colicky and cramp-like abdominal pain, nausea, and vomiting. Rectal bleeding was rare and indicated ulceration of the lipoma or intussusception. The average age in the symptomatic group was 52.5 years. None of the tumors in this group involved the stomach; 2 were in the ileum and 11 in the colon.

The roentgen signs of a lipoma are those of tumor. Unlike carcinoma, lipoma seldom involves the entire circumference of the intestinal wall. It may be sessile or pedunculated; if pedunculated, it may cause dimpling or narrowing at its point of origin. A lipoma is frequently lobulated but is smooth in outline; it may be ulcerated, but this may not be recognized roentgenologically. It may produce the characteristic appearance of an intramural tumor.

Intussusception is relatively rare in adults. It occurs, however, in association with approximately 50 per cent of symptomatic lipomas. The roentgen signs are classical: The tumor usually forms the leading edge of the intussusception. Barium coating the folds of the surrounding bowel gives the characteristic appearance of multiple rings. When a roentgen diagnosis of intussusception is made, the possibility of lipoma should always be taken into consideration.

Treatment consists of surgical removal because of the impossibility of making a positive tissue diagnosis from the films and because of the ever-present danger of subsequent intussusception at the lipoma site.

Seven roentgenograms. A. A. RAYLE, JR., M.D.
Cleveland Clinic Foundation

Hirschsprung's Disease. Martin Bodian, F. Douglas Stephens, and B. C. H. Ward. Lancet **1:** 19–22, Jan. 7, 1950.

The purpose of the present communication is to record the results of a clinical and radiologic follow-up, for over a year, of 12 previously published cases of Hirschsprung's disease treated by rectosigmoidectomy (Lancet **1:** 6, 1949), to report an additional 14 cases, and to discuss the pathologic findings in a total of 28 specimens.

In their previous article, the authors presented clinical, radiologic, and pathologic evidence for a new conception of the organic etiology of Hirschsprung's disease, thus separating it from idiopathic megacolon. Distal to the hypertrophied "megacolon," a narrow segment was invariably demonstrated by careful radiologic study. Clinical evidence placed the site of the obstruction in this relatively unimpressive distal segment, and histologic examination of the entire intestinal tract in two fatal cases revealed complete absence of ganglion cells from the intramural plexuses of this portion of the bowel. It was postulated that this would

impair co-ordinated propulsive movement and lead to secondary hypertrophy and dilatation proximal to the lesion. On this assumption a new surgical technic, removal of the abnormal distal segment (rectosigmoidectomy), was used in 12 children, and the pathology was uniformly confirmed.

The clinical course in these 12 cases has been satisfactory during the last twelve to fifteen months. All of the children are in excellent health, with normal bowel habits. All show improvement radiologically. Plain films of the abdomen reveal a little more than the average amount of gas in the colon and no excess of feces. Barium enema studies were performed by the technic previously reported. Only the segment of colon adjacent to the anus was filled, this being the part which before operation was adjacent to the aganglionic segment. In 3 cases this part of the colon was almost within normal limits. In 7 cases the colon, while much reduced in size, was still above the normal diameter. Haustrations had not reappeared, and where the gut was not distended by gas or emulsion it had a wrinkled and folded appearance. It follows that, owing to the prolonged distention and hypertrophy, the volume of the full colon and surface area of the collapsed colon are both greater than normal. In 2 cases where the preoperative examination was made in infancy, and only moderate distention was demonstrated, the absolute size of the bowel showed little change postoperatively, but relative to the size of the child it more nearly approximated the normal. Further observation will be necessary in all cases to determine the end-point of the regressive changes.

Of the 14 children more recently treated, 2 died, 9 were making satisfactory progress, and in 3 the interval since operation was too short for evaluation of the results.

[The authors cite the similar observations of Swenson and his associates on megacolon (see, for example, Pediatrics **4:** 201, 1949. Abst. in Radiology **55:** 149, 1950), though their own work appears to have been done independently.—Ed.]

Four roentgenograms; 1 drawing.

Pancreatic Cyst. James Vickers Scott. Arch. Surg. **59:** 1304–1318, December 1949.

In 160,011 admissions to Mercy Hospital (Pittsburgh) in a period of over twelve years, only 8 cases of pancreatic cyst were seen. The patients are usually women.

A cyst arising in the pancreatic head first enlarges the duodenal loop and later presses on the pyloric and prepyloric regions of the stomach, the third portion of the duodenum, and the transverse colon. If the cyst originates in the most lateral (right) portion of the head of the pancreas, the first and second portion of the duodenum may be displaced medially and anteriorly. A cyst in the neck presses on the posterior wall of the prepyloric region; of the body, on the posterior wall of the mid portion of the stomach and downward on the transverse mesocolon; those of the tail displace the greater curvature, the duodenojejunal flexure, and the first portion of the jejunum, and if large, they may distort the proximal loop of the splenic flexure. The degenerative cyst, or pseudocyst, is the most frequent type, and its causation is not clearly understood. Anatomical features favoring segmental duct blockage, inflammatory changes, and trauma play a part in cyst formation.

The most common symptom is pain, varying from a dull ache to a severe colic, and commonly felt in the epigastric or left hypochondriac region, with radiation to the back. Loss of weight, weakness, jaundice, nausea, and vomiting are common. A palpable upper abdominal mass is the most constant single diagnostic finding. Much reliance must be placed on the x-ray studies of the gastro-intestinal tract, since a cyst large enough to produce symptoms will usually produce typical roentgenographic defects. The following features are of diagnostic importance:

1. An extensive palpable tumor is most likely extrinsic to the stomach.
2. Widening of the duodenal curve is significant of enlargement in the region of the pancreatic head. This may also be seen in obesity, in case of relaxed diaphragm with high stomach, and in ascites.
3. Increase in the distance between the stomach and the vertebral column may be apparent in the lateral view.
4. There may be constant filling of the duodenum, as opposed to the normal rapid filling and emptying.
5. There may be elevation and/or diminished excursion of the left diaphragm.
6. In the more obese patients, a plain film of the abdomen may show a shadow which, by its position and relationship to other organs, may be identified as a new growth of the pancreas.
7. The duodenum is not usually displaced forward by lesions in the head of the pancreas (except those in the extreme right portion of the head).
8. When the lesser curvature of the stomach is displaced, the defective shadow is of smooth contour and concave toward the tumor, and the gastric edges are indistinct. Peristaltic waves pass through the area freely, and pressure changes the shape of the defect or makes it disappear.
9. Cysts of the tail produce a pressure defect of the greater curvature when the patient is prone, with displacement upward and to the right. This disappears when the patient stands. There may be displacement of the duodenojejunal angle downward with compression stasis in the third portion of the duodenum and poor filling of the first loop of jejunum. Compression or downward displacement of the splenic flexure is seen in large cysts.
10. Calcification of the cyst is occasionally present.

Laboratory studies are not specific. The treatment of choice is complete excision, but this is not always possible, and a high mortality (55 per cent) follows an unsuccessful attempt. Alternatives are internal drainage and external drainage by marsupialization, both of which are sometimes successful; re-formation of the cyst commonly complicates the latter.

A bizarre case is reported in which the pressure defect of the stomach closely mimicked a pyloric carcinoma, although both at operation and by re-examination with barium after excision of the cyst the stomach appeared normal.

Two roentgenograms; 1 drawing; 1 table.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Pancreatic Calculosis. Diagnosis Often Possible Without Extensive Procedures. R. Louis Cope. South. M. J. **42:** 1060–1063, December 1949.

Pancreatic calculosis, while admittedly rare, is found frequently enough to be kept in mind in cases of abdominal pain. The cause is not known. The clinical diagnosis rests mainly on a triad of symptoms and

signs: (1) epigastric pain, often radiating to the left and to the back; (2) diabetes mellitus, frank or latent (found in almost 50 per cent of cases); (3) diarrhea or steatorrhea occurring at one time or another in the course of the disease (perhaps in almost 50 per cent of cases). The definite diagnosis depends upon the demonstration of calcareous deposits in the region of the pancreas in the roentgenogram of the abdomen. Oblique views are helpful in this respect.

The author reports two cases which he saw within six months of each other on a 25-bed medical service. The diagnosis was made in each instance by the demonstration of calcium shadows in the region of the pancreas. In neither case, however, was the diagnosis verified by pathological examination of a surgical or postmortem specimen.

Conservative treatment is probably indicated in most cases, directed toward relief of pain. The pain will ultimately be relieved physiologically by complete atrophy of the gland, but this may require years. The associated diabetes must also be treated.

One roentgenogram. T. F. WEILAND, M.D.
Jefferson Medical College

Emphysematous Cholecystitis. Jack Friedman, J. Richards Aurelius, and Leo G. Rigler. Am. J. Roentgenol. **62:** 814–822, December 1949.

Emphysematous cholecystitis is a disease of the gallbladder and associated ducts due to intrinsic inflammatory change wrought by gas-forming organisms. Sixteen cases of this rare pathological entity have been found in the literature, and 4 new cases are added. In 7 of these patients there was associated diabetes.

The clinical picture is indistinguishable from acute cholecystitis without gas formation. Cholecystectomy was performed on 12 cases, but most authors believe that conservative therapy is the treatment of choice. The gross pathological change consisted in an inflammatory thickening of the gallbladder wall. A mixture of gas and foul exudate both within the lumen and the wall of the organ and associated ducts was found. *Cl. welchii* was obtained in the majority of cases on culture. *E. coli*, streptococci, and *Staphylococcus albus* were also found.

The characteristic roentgen picture of streaked "bubbly" gas within the wall of the gallbladder and in the pericholecystic tissues is pathognomonic for emphysematous cholecystitis. In the early stages gas may be demonstrable only in the lumen and such cases must be differentiated from internal biliary fistulae and incompetence of the sphincter of Oddi.

Eight roentgenograms. J. C. NEERING, M.D.
Cleveland Clinic Foundation

Cholangiography in Biliary Surgery. Clinical and Therapeutic Considerations. F. Rodríguez Ruiz-Conde and Félix Millán Navarro. Prensa méd. argent. **36:** 2543–2547, Dec. 2, 1949. (In Spanish)

Cholangiography, either operative or postoperative, is of real value as an aid to biliary surgery. Not only can concretions or anatomic lesions be recognized, but even functional disturbances of the terminal common duct. Hepatic colic, pain, and dyspepsia, symptoms from which surgical patients suffer, are often explained by residual calculi or alterations of the terminal portion of the common duct, the detection of which cannot be achieved in any other way than by cholangiography. The great difficulty in this practice is encountered in the correct interpretation of the roentgenograms; some shadows offer no difficulties, such as filling defects produced by one or more common duct stones, but when there is absolute or partial obstruction to the passage of the contrast material, it is difficult to decide whether the cause is Odditis, pancreatitis, small ampullar calculus, a functionally hypertonic sphincter, or several of these lesions operating in concert.

In considering operative cholangiography, the authors first decide if the obstruction is total or partial and whether it is attributable to stone or to an anatomic or functional disturbance of the duodenal end of the duct. Radiologic proof of such obstruction is offered by the dilated common duct and by injection of the hepatic duct and its branches. If no shadow appears in the duodenum, the obstruction is total. If there is a little flow into the duodenum, the obstruction is partial.

Eight drawings. JAMES T. CASE, M.D.
Chicago, Ill.

Operative Findings After X-Ray Examination of the Gallbladder, with Special Reference to Negative Cholecystography. Wilhelm Kraus. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 916–924, October 1949. (In German).

In only one-fifth of the author's series of cases were gallstones visualized in the precholecystographic survey film. In another fifth of the cases, the gallstones became visible after cholecystography. In the remaining cases no gallbladder visualization took place even after administration of dye. In about 80 per cent of all cases gallstones were found during operation. In only 3 per cent of the cases in which cholecystography was done was the result of the examination inconclusive.

Four tables. ERNST A. SCHMIDT, M.D.
Denver, Colo.

HERNIA

Problem of the Acquired Short Esophagus. Report of Eighteen Patients. H. Brodie Stephens. California Med. **71:** 385–390, December 1949.

This author states that most cases of shortened esophagus and partial thoracic stomach are acquired, developing at the sliding or gastro-esophageal type of hiatal hernia. The lower end of the esophagus is bathed with acid from the stomach. This produces recurrent acute esophagitis, followed by chronic esophagitis, then acute ulceration, then chronic ulceration, with surrounding induration producing stenosis. Above the stricture the process tends to repeat itself. Each succeeding attack of acute ulceration produces more shortening of the esophagus and draws more of the stomach into the chest.

A series of 18 cases (11 in males and 7 in females) believed to represent the acquired type of shortened esophagus was observed by the author. Most had had symptoms for several years—pain high in the epigastric area, greatest in the recumbent position, dysphagia, and vomiting. Bleeding occurred in one-third.

The diagnosis should be made by roentgen studies and use of the esophagoscope. For the roentgen examination, it is frequently necessary that the patient be in the recumbent position in order that the small sliding type of hernia may be brought out. Not infrequently the stricture at the cardio-esophageal junction will ex-

actly mimic the appearance of carcinoma of the esophagus. If the radiologist does not attempt to demonstrate the supradiaphragmatic stomach, the diagnosis can easily be overlooked.

Conservative treatment—dilation of constriction, proper diet, sleeping in the upright position and weight reduction—was sufficient to relieve 8 of the author's patients. Surgical repair of the hernia is indicated in the early cases, as the surgical problem is relatively simple at this time and the lesion is progressive.

Two roentgenograms; 1 drawing; 2 charts; 4 tables.

BERNARD S. KALAYJIAN, M.D.
Detroit, Mich.

Diaphragmatic Hernia through the Foramen of Morgagni. R. Robert DeNicola and Daniel J. Vracin. J. Pediat. **36:** 100–104, January 1950.

A case of diaphragmatic hernia through the foramen of Morgagni is presented. The patient, a boy of 2 years, had a history of digestive disturbances since birth. In the week preceding admission. he had three attacks of coughing and vomiting, became blue, and fought for breath. Physical examination was negative. A chest roentgenogram was interpreted as showing right lower lobe pneumonia with partial atelectasis. Findings on bronchoscopy and bronchography were normal, as was a barium enema study. A gastro-intestinal series showed barium in the small intestine above the right diaphragm and lateral films revealed the point of herniation between the anterior part of the diaphragm and the anterior abdominal wall. The diagnosis of hernia through the foramen of Morgagni was verified at operation, and the defect was repaired.

Six roentgenograms. PAUL W. ROMAN, M.D.
Baltimore, Md.

THE SPLEEN

Diagnostic Features of Splenic Cysts with Case Report and Review of the Literature. Arthur A. Fischl and Jean Papps. Ann. Int. Med. **31:** 1105–1112, December 1949.

The diagnostic features of splenic cysts are usually quite evident and offer a basis for their preoperative recognition. Symptoms referable to the left upper quadrant and just under the left costal margin are significant. Pain depends on the size of the mass. A large one may cause the patient to complain of a heavy dragging pain; a smaller one may be less disturbing. The mass usually is soft and cystic. If the cyst is of the inflammatory variety, a febrile reaction will obtain. The presence of a fixed left diaphragm with diminished breath sounds is characteristic.

Roentgenologically, visceral displacement is demonstrable, with elevation of the left diaphragm and impairment of its motion. The barium-filled stomach is displaced to the right and the colon is pushed down and to the right. The left kidney may also be displaced downward. Calcification may occur.

Pancreatic and ovarian cysts may present a differential problem, but they do not offer resistance to the left costal margin. Ovarian cysts may be traced into the pelvis, whereas splenic cysts enlarge transversely. The large leukemic spleen also grows down toward the pelvis, and spreading of the ribs and left involvement of the diaphragm are not seen.

The author reports a case in a young woman whose chief complaint was pain in the left lower anterolateral thoracic region. Physical examination showed a diffuse swelling in the left upper quadrant of the abdomen, which seemed soft and cystic. The left diaphragm was fixed, and the roentgenograms revealed displacement of the stomach. Displacement of the kidney was also demonstrable, but this was thought to be congenital and not related to the splenic cyst. At operation the spleen was found to consist largely of loculated cystic areas lined by a calcified tissue.

Four roentgenograms; 1 photograph.

STEPHEN N. TAGER, M.D.
Urbana, Ill.

THE MUSCULOSKELETAL SYSTEM

Osteomalacia. Mary S. Sherman. J. Bone & Joint Surg. **32-A:** 193–206, January 1950.

An extensive study of the history of osteomalacia together with an exhaustive bibliography on the subject is presented. The term osteomalacia describes a condition in adults wherein the bone shows an abnormal amount of osteoid tissue. The diagnosis rests necessarily on the microscopic appearance of the bone. It can be the result of any condition that depletes the calcium stores in the body. The author bases her discussion of possible etiologic factors upon Albright's classification (Albright *et al.:* Medicine **25:** 399, 1946), mentioning first lack of vitamin D due to dietary restriction or to gastro-intestinal disturbances such as sprue and steatorrhea, in which the fat-soluble vitamin is not absorbed. Osteomalacia may also occur with renal acidosis, in which there is a decreased ability to secrete acid radicals and calcium in the body is called upon to act as a base. A similar condition exists in Fanconi's syndrome, though osteomalacia is only one of the several manifestations in this rare congenital defect. In idiopathic hypercalcuria the patients have a low kidney threshold for calcium.

Two extensive case reports of osteomalacia are included, in which microscopic study showed abnormal amounts of steroid tissue. Roentgenograms in these cases showed reduction of the density of the bone and fractures. Although these are only the fourth and fifth cases of osteomalacia reported in North America, the author states that it is obvious that the disease is not so rare on this continent as has been believed.

Seven illustrations, including 3 roentgenograms.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Gargoylism. S. F. Lemahieu. J. belge de radiol. **32:** 214–229, December 1949. (In French)

Gargoylism was described for the first time by Gertrude Hurler of Munich in 1919. It is a congenital affection, rarely familial, of which the etiology remains unknown and which is manifested at an early age, in a progressive fashion, by a generalized, symmetrical dysostosis resulting in disproportionate dwarfism with large head, swollen, grotesque face, large, ugly features, short neck, protuberant abdomen and dorsolumbar kyphosis; hepatosplenomegaly; mental retardation progressing to complete idiocy; bilateral corneal opacities; and often limitation of movements and stiffness of articulation. Hypertelorism may be present.

Radiologically the syndrome is characterized by multiple, symmetrical deformations of the skeleton,

which fall in the group of mixed osteochondrodystrophies with alteration of enchondral and periosteal ossification. The chondro-osteodystrophy may occur in the absence of lipoidosis. Newborn infants present few anomalies on roentgen examination, but at one or two years of age the pathognomonic signs are present. The most characteristic anomalies are found in the vertebral column, hands, and skull.

The dorsolumbar kyphosis seems to be due to an elective hypoplasia of the anterosuperior portion of the vertebral bodies, especially localized between the lower thoracic and upper lumbar vertebrae. The cuneiform vertebrae may even present a spondylolisthesis, the intervertebral articulations being equally hypoplastic.

The long bones of the upper extremity are spindle-shaped, being wider in the mid-portion and thinner at the extremities. This is in contrast to what is seen in fetal chondrodystrophy. The epiphyseal nuclei appear late and fuse with the shaft later than usual.

The thorax is at times deformed, but never to the point of simulating Morquio's disease.

The bones of the hand are very characteristic. The metacarpals and phalanges are short and thick with prominent trabeculation.

The skull is clearly enlarged, and generally deformed, presenting a dolichocephalic shape, with tendency to scaphocephaly. The frontoparietal suture persists, and the large fontanelle may close late. It is not exceptional to find a certain degree of hydrocephaly. Brachycephaly is also encountered. The bones of the base of the skull seem clearly inhibited in their development, and this is reflected in a facial compression. The sella turcica is elongated, shallow, and the clinoids are irregular. Mastoid pneumatization is practically absent.

The radiologic aspect of the inferior members is somewhat less typical. The ischiopubic branches are frequently poorly developed, while the defective cotyloid cavities often lead to subluxation of the femoral heads. Coxa valga, genu valgum and pes planus are common. Chondromatous exostoses are often found in the tarsal bones.

Differentiation from the other chondrodystrophies is of prime importance to the radiologist. In fetal or achondroplastic chondrodystrophy there is marked delay in enchondral growth, producing micromelic dwarfism. The long bones are short, and the enlarged epiphyses overhang the bone. Hypoplastic and hyperplastic forms are recognized.

Morquio's atypical chondrodystrophy seems to be a variant of hyperplastic chondrodystrophy with osteomalacic deformations of the skeleton. The extreme thoracic deformity, normal skull, more frequent involvement of the lower extremities, articular hyperluxation, and familial incidence differentiate this from gargoylism. Nearly all the vertebrae are involved, a Pott's-like gibbus and keel-shaped sternum being characteristic.

Ollier's enchondromatosis and multiple cartilaginous exostoses are easily distinguished. Léri's familial pleonosteosis (melorhestosis) affects particularly the extremities. The arms are found fixed in internal rotation, while the forearms are pronated. The large square hands have digits ankylosed in flexion.

The polyosteochondritis of Clément presents morcellated epiphyseal nuclei.

In none of these affections are hepatosplenomegaly, corneal opacities, or mental retardation found. Other lipoidoses do not present the skeletal changes. In cretins, ossification is delayed but true deformities are not seen.

Six roentgenograms; 2 photographs.

CHARLES NICE, M.D.
University of Minnesota

Morquio-Brailsford's Disease Simulating the Arthritic Manifestation of Rheumatoid Disease. Philip Ellman. Ann. Rheumat. Dis. **8:** 267–276, December 1949.

Rheumatoid disease in its acute or chronic form with its systemic or local manifestations may at one time or another simulate many diseases. Its local joint manifestations may resemble many specific arthritides and bony lesions with secondary joint involvement. The author presents 2 cases of chrondro-osseous dystrophy of the Morquio-Brailsford type, one of which, and possibly the other, had at first been regarded as due to an arthritic manifestation of "rheumatoid disease."

The primary disorder in Morquio-Brailsford's disease is an abnormality of development of the skeletal tissues, which may vary in severity from changes apparently incompatible with life to mild deformities of the trunk or limbs. It is characterized by multiple irregular centers of ossification in the epiphyses and diaphyses, followed later by superimposed secondary deformities and marked muscle weakness, but even more characteristic are the constant changes in the spine—"the shallow flattened vertebra with, in typical cases, the characteristic shape in the lateral view of the central tongue projecting." The epiphyseal changes occur most frequently in the hips; the majority of cases show a large irregular acetabulum.

Brailsford has divided the reported cases into four separate groups: Group A is the most severe form, in which the spine and hip joints are mainly affected. The epiphyses of the long bones are much larger and the shafts shorter and thicker than normal. The feet and hands are also deformed, but the skull remains unaffected. With an associated muscle weakness, cases in this group run a progressively downhill course. Group B is a variation of Group A in that the same joints are affected, but the active phase seems to exhaust itself by the time puberty is reached, leaving crippling malformations. In Group C the disorder is confined to the spine and hip joints, although the knees are occasionally affected. In Group D only the vertebral column is involved.

The author's cases showed the typical limitation of stature and short trunk, with disproportionately long limbs and joint abnormalities arising in the epiphyses. They bear more similarity to Group B than to the other groups.

There was consanguinity of the parents in both instances, which appears to be a constant finding in all similar cases reported.

Fourteen roentgenograms; 8 photographs.

Extension of Primary Neoplasms of Bone to Bone Marrow. Jackson E. Upshaw, John R. McDonald, and Ralph K. Ghormley. Surg., Gynec. & Obst. **89:** 704–714, December 1949.

Almost a century ago it was established that the medulla of a bone may be affected not only at the immediate seat of a tumor but at some distance beyond. The present study, however, is believed to be the first devoted primarily to the characteristics of extension of individual bone neoplasms to marrow. Three types of

tumor were studied: 50 osteogenic sarcomas, 20 Ewing's tumors, and 5 primary chondrosarcomas. All were in the long bones of the extremities.

The tumors were studied grossly, microscopically and by roentgenograms. In one-fifth of the osteogenic sarcomas medullary extension ranged from 3 inches to involvement of the entire shaft and in one-fifth from 1 to 3 inches. In the remaining three-fifths no medullary extension could be demonstrated. Ewing's tumor showed a greater tendency to extension, with the entire medullary cavity involved in 30 per cent of the group, and extension for 1 or more inches in an additional 45 per cent. No gross or microscopic evidence of extension was found in the cases of chondrosarcoma.

The comparison between the degree of medullary extension seen on the preoperative roentgenograms as against that actually found by gross and microscopic study of the amputated extremities is of interest to the radiologist. *The distance by which microscopic extension exceeded roentgen evidence of medullary involvement varied from zero to involvement of the entire shaft.* Microscopic evidence of medullary involvement not apparent on roentgenograms was obtained in 31 per cent of the osteogenic sarcomas and 56 per cent of the Ewing's tumors.

No correlation can be established between the overall survival rates after surgery and the amount of medullary extension in osteogenic sarcoma, but in Ewing's tumors those lesions that show the greater tendency to medullary spread are more likely to invade blood vessels early and to have caused undetected metastatic lesions at the time of surgery.

One roentgenogram; 4 photomicrographs; 7 tables.

DANIEL TALLEY, III, M.D.
University of Pennsylvania

Renal Osteodystrophy Associated with Diabetes Mellitus. Congenital Polycystic Hypoplasia of the Kidneys and Polycystic Disease of the Pancreas. Albert Jackson, George C. Bates, Manuel Slavin, and M. Donald McFarland. Arch. Int. Med. **85:** 11–26, January 1950.

The triad of chronic nephritis, bony changes, and physical dwarfism has been designated as renal rickets. The authors believe that this is a misnomer in that the bony changes are not characteristic of rickets and it is not necessary that rickets be associated with this syndrome. They prefer, therefore, to use the term "renal osteodystrophy."

In practically all patients with this disease the kidneys are small, granular, and sclerotic. There is a severe renal insufficiency which leads to retention of phosphates with accumulation in the blood and excretion through the intestinal mucosa. The increased concentration of phosphates in the intestines interferes with the absorption of calcium by the formation of insoluble calcium phosphates. This leads to reduced calcium concentration and high phosphorus content of the blood. Secondary hyperparathyroidism is almost always present as a result of the low blood calcium. The overactivity of the parathyroid glands may cause the bony changes, although the acidosis which usually is present is sufficient of itself to do this.

The bony changes show a varied picture with osteoporosis predominating. When the disease occurs in children, the endochondral changes are great, with thickening and deformity of the proliferating cartilage of the long bones because of mechanical stress in the absence of adequate deposition of lime salt. In adults, there is absorption of bone with osteoporosis, formation of cysts, secondary fibrosis, and proliferation of connective tissue. Rickets may or may not be present.

The authors report a case of renal osteodystrophy in an adult with chronic azotemia and diabetes mellitus. Roentgenograms demonstrated considerable cortical thickening, a woolly appearance of trabecular structures, and multiple tiny cysts in the cortical portion of the long bones. The pelvis, vertebrae, calvarium, and mandible appeared osteoporotic. The distal 2.5 cm. of each clavicle was absent. There were erosion and destructive changes of the terminal phalanges. Intravenous urograms showed small kidneys, which failed to excrete the contrast material. Retrograde pyelograms also showed the renal outline to be greatly decreased in size.

The postmortem anatomic diagnosis was congenital polycystic hypoplasia of the kidneys; congenital polycystic disease of the pancreas; hypertrophy and hyperplasia of the parathyroid glands; osteitis fibrosa cystica (secondary). The diabetes mellitus probably was secondary to the polycystic disease of the pancreas.

Eight illustrations, including 3 roentgenograms; 1 table.

HOWARD L. STEINBACH, M.D.
University of California

Pseudohypoparathyroidism (The Seabright Bantam Syndrome). Charles Upton Lowe, Albert J. Ellinger, William S. Wright, and Herbert M. Stauffer. J. Pediat. **36:** 1–10, January 1950.

In 1942 Albright *et al.* (Endocrinology **30:** 922, 1942) proposed the designation Seabright bantam syndrome for pseudohypoparathyroidism, by analogy with the condition observed in Seabright bantam roosters. These roosters have female tail feathers, presumably because of failure to respond to male sex hormone. In pseudohypoparathyroidism, which in all other respects resembles true hypoparathyroidism, there is a failure to respond to administration of parathyroid extract by phosphate diuresis. This, Albright suggested, might be due to overstimulation of the end-organ (kidney) by the hormone.

The authors report a case of this unusual condition and suggest "with some hesitation" an hypothesis regarding its pathogenesis. Their patient was a child with a rather complicated history. She had apparently had steatorrhea from birth. At the age of four months she showed hypocalcemia and hyperphosphatemia which responded to parenteral vitamin D. At four years of age there was tetany associated with abnormal blood values for calcium and phosphorus. This was relieved by intravenous calcium salts. At that time a study of the urinary phosphate excretion following intravenous administration of parathyroid extract was done. There was no increased phosphaturia. Roentgenograms revealed abnormal bone trabeculation and dense metaphyseal bone.

The authors present the thesis that in their case the underlying cause for this syndrome was chronic steatorrhea. This led to prolonged parathyroid stimulation and later produced the changes of hypoparathyroidism and failure of the kidney to respond to parathormone.

Four roentgenograms; 2 photographs; 1 table.

PAUL W. ROMAN, M.D.
Baltimore, Md.

Low Back and Rectal Pain from an Orthopedic and Proctologic Viewpoint with a Review of 180 Cases. Saul Schapiro. Am. J. Surg. **79:** 117–126, January 1950.

The author reviews the anatomical attachments of the external anal sphincter, anococcygeal ligament, levator ani, coccygeus, sacrotuberous ligament, and gluteus maximus to the sacrum and coccyx, explaining how involvement of these bones affects the respective muscles and nerves and thereby causes tenderness, spasm, and reflex symptoms. Particular attention is given to the sciatic nerve passing between the piriformis muscle and the sacrospinous ligament.

One hundred and eighty cases of low back and rectal pain are reviewed. These are classified in six groups: (1) originating in ligamentous sacroiliac strain; (2) associated with coccygodynia; (3) associated with bony abnormality in the sacrococcygeal region; (4) without demonstrable rectal or sacrococcygeal disturbance; (5) with demonstrable rectal disease; (6) following rectal surgery. Common to all of these six groups was tenderness or spasm of the levator ani, coccygeus, and piriformis muscles on one or both sides as revealed by digital rectal examination. In those cases in which a definite organic condition was present, such as sacroiliac strain or fracture of the coccyx, massage and/or intrarectal diathermy of the spastic muscles were often necessary for complete relief of the pain after correction of the underlying lesion.

The author suggests naming the syndrome consisting of coccygodynia due to tonic spasm of the piriformis, coccygeus, and levator ani muscles the "Thiele syndrome," as it was first described in detail by Thiele. Treatment here again is rectal massage.

Twenty-four spot roentgenograms of abnormalities of the coccyx are reproduced (poorly). The author advocates a special spot cone technic as a routine in all cases of low back and rectal pain and urges more "liberal" interpretation of such studies.

Thirty-two illustrations.

ROBERT L. RAPHAEL, M.D.
University of Pennsylvania

Mechanism of Rotation in Combination with Lateral Deviation in the Normal Spine. Alvin M. Arkin. J. Bone & Joint Surg. **32-A:** 180–188, January 1950.

The author's purpose, as stated at the beginning of this paper, is "to investigate the combination of rotation with lateral deviation in the *normal* spine, to describe the underlying causes for such rotation, and to discuss some concepts currently accepted."

He first studied the effect of stress upon straight rubber forms, curved rubber forms, and S-shaped rubber forms. In all the appearance of convex-side rotation was observed, and the edge under greater tension formed the straighter line, both in flexion and extension. An articulated vertebral column was then studied with a strip of ribbon attached to the tips of the spinous processes and another attached to the midline of the bodies anteriorly. When lateral deviation was produced in this articulated spine, flexion led to convex-side rotation, while lateral deviation in extension produced concave-side rotation. This was not due to the articular facets but rather to the ribbons, which represent the ligaments.

In a living subject, however, other influences obtain, and the part played by muscular contraction comes into play. Fifty-four roentgenograms of the spine were made in 8 living subjects of various ages, including views in sitting, standing, and recumbent positions, and with the hips flexed or extended.

It was found that, in adults, convex-side rotation appeared when the spine was in lateral deviation, either in flexion, extension, or in neutral position. Concave-side rotation could not be obtained in active or passive hyperextension or in any position. Children showed less tendency to rotation with the spine in lateral deviation. With one exception there was only slight convex-side rotation or none at all.

Thirteen illustrations, including 6 roentgenograms.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

Lateral Roentgenographic Examination of the Thoracic Spine. Geraldo Guerreiro. J. Bone & Joint Surg. **32-A:** 192, January 1950.

In an effort to demonstrate more clearly the thoracic spine, the author has obtained the lateral view with the patient in an orthostatic position with a vertebral support. The patient was told to breathe slowly and deeply during the exposure. The factors were 50 kv., 15 ma., 15 seconds, focal distance 2 meters. With this technic there is a complete disappearance of the ribs and the vertebral bodies and the posterior arches are beautifully shown. The aortic arch was also strikingly demonstrated.

Two roentgenograms. JOHN B. MCANENY, M.D.
Johnstown, Penna.

Prolapse of the Nucleus Pulposus in the Cervical Region, Accompanied by Compression of the Spinal Cord, with Report of a Case. James Isbister. M. J. Australia **2:** 910–913, Dec. 24, 1949.

Disk protrusions occur most frequently in the cervical and lumbar areas of the spine because of their greater mobility and exposure to trauma, as well as the lordotic curvature. In the cervical area the cord practically fills the canal and the nerve roots are almost horizontal, accounting for the frequency of cord compression and the lesser tendency for root pain as compared with the lumbar area, where the roots may pass several disks before leaving the canal. Root pain does occur, however, in many cases after narrowing of the interspace, and consequently of the intervertebral foramen, takes place.

The onset of symptoms from a prolapsed cervical disk is usually insidious but may be acute or intermittent. In some cases a Brown-Séquard syndrome occurs—segmental lower motor neuron weakness and atrophy, upper motor neuron effect on the same side below this level (spastic paresis with exaggerated reflexes), and loss of pain and temperature sense on the opposite side below the level of involvement. Spinal fluid protein is usually elevated and a block may be demonstrated.

Findings on plain films leading to a suspicion of this condition have been enumerated by Murphey *et al.* (Am. J. Roentgenol. **56:** 27, 1946. Abst. in Radiology **48:** 552, 1947). They are (1) scoliosis [?], (2) loss or reversal of lordosis, (3) posterior calcification (especially if visualized in the foramen on oblique views), (4) encroachment on the intervertebral foramen with or without osteophytes, and (5) localized arthrosis with narrowing of the joint space. Myelography should be positive, at least to the extent of demonstrating a block.

As regards treatment, some authors recommend surgery; others regard rest, immobilization, or possibly

traction as constituting adequate therapy. When cord compression is present, surgery is indicated because of the risk of paraplegia from an increase in the amount of protrusion. Function is usually recovered if compression is of short duration but not if a long period of time has elapsed.

A single case is reported in detail. The early literature on disk protrusion is covered.

Two roentgenograms; 3 diagrams.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Hydatid Disease of Vertebrae. Leslie J. Woodland. M. J. Australia **2:** 904–910, Dec. 24, 1949.

Hydatid disease of the vertebrae is a rather difficult diagnosis to make on the basis of film findings alone but should be possible if a good history is available and the possibility kept in mind.

Cyst-like areas such as are seen in other bones do not usually occur but there are some destruction and sclerosis over an area out of proportion to the duration of symptoms. This is because the disease remains confined to the bone for a long time and progresses very slowly as long as it is so confined. Once the bone is broken through, extraosseous spread in the muscles or in the spinal canal proceeds rapidly and soon causes symptoms. Hydatid disease does not produce expansion or periosteal reaction. The disks may be involved but usually relatively late in the course of the disease. In the thoracic area it is usual for the contiguous ribs to be affected, and here the more typical cyst-like destruction is seen.

Recurrence, infection, and hemorrhage are frequent complications of surgery in this condition. Laminectomy may have to be done repeatedly to relieve cord pressure. Various types of infections and tumors must be considered in the differential diagnosis.

Six cases are reported in detail in the paper, which is recommended in the original for its excellent coverage of the subject. Unfortunately the illustrations are not very well reproduced.

Five roentgenograms; 2 drawings.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Pyogenic Arthritis with Pathologic Dislocation of the Hip in Infants. Jesse T. Nicholson. J. A. M. A. **141:** 826–830, Nov. 19, 1949.

The author presents a study of 10 cases of pyogenic arthritis with pathologic dislocation of one or both hips before the age of eighteen months. In every instance there was a primary infection elsewhere: bilateral otitis media in 5 cases (with and without pneumonia), sinusitis in 2, fetal erythroblastosis with septicemia in 1, parotitis with septicemia in 1, and a skin eruption in 1. Streptococci, pneumococci, and staphylcocci were the organisms recovered. Six of the 10 children had other metastatic infections.

The diagnosis of hip sepsis is based upon the following observations: a primary infection, the involved thigh held in flexion, irritability of infant on attempts to move the involved leg, enlargement of the thigh, and positive smear and culture from aspiration of the joint.

The pathologic dislocation of the hip is diagnosed by a deeper or extra transverse crease in the thigh and restriction of abduction on the involved side. Roentgenograms show an elevated position of the upper femoral metaphysis, a lateral displacement of this metaphysis, and sufficient development of the acetabular rim to meet the specification for a normal hip socket of an angle of 30 degrees or less with the horizontal. The necessity of early recognition is stressed.

Sequelae and treatment are discussed at length.

Eleven roentgenograms; 2 drawings; 1 table.

DAVID J. SAYLES, M.D.
University of Michigan

Epiphyseal Destruction by Frostbite. H. E. Thelander. J. Pediat. **36:** 105–106, January 1950.

A case of epiphyseal destruction resulting from frostbite is reported. A boy, aged 9, had had severe frostbite of the right hand two and a half years previously. Physical examination showed the fingers of the right hand to be shorter than those of the left, while a roentgenogram demonstrated absence of the epiphyses of the middle and distal phalanges of the second to fifth fingers. The diaphyses were roughened and shortened, and the joint spaces thinned.

This case is worthy of report as illustrative of a very infrequent cause of epiphyseal destruction.

One roentgenogram. PAUL W. ROMAN, M.D.
Baltimore, Md.

Fractures of the Calcaneus. George E. Wilson. J. Bone & Joint Surg. **32-A:** 59–70, January 1950.

This is a detailed study of the anatomical and radiographic appearance of the calcaneus both normally and in the presence of fractures. This bone supports much of the weight of the body, and its injury can lead to great disability.

Knowledge of the detailed anatomy of the calcaneus is important, but more important is the radiographic picture, since the appearance of the articular portions of the bone differs in views obtained with the foot in inversion and eversion. The authors have designated as a "ceiling line" an imaginary line connecting the anterosuperior with the posterosuperior angle. With the foot in eversion, only the part of the bone immediately behind the posterior facet lies above this line, while in inversion the sustentaculum tali also rises above it. In the normal plantar projection, because of the obliquity of the rays and other variables, there is necessarily a good deal of distortion, but with practice there should be no trouble in interpreting the films.

Injuries to the calcaneus are of various types. The most common appearance in the lateral view is a depression of the area represented by the middle and posterior facets and the bone immediately adjoining them. The fracture line is triradiate, commencing just behind the posterior peak and proceeding downward for an inch or so before it bifurcates. One limb then proceeds anteriorly and upward into the region of the middle facet, while the other opens on the inferior surface. In most severe cases, the superior surface of the bone is markedly concave, both peaks being below the "ceiling line." In almost every instance of this kind, the normal relationship between the facets is disturbed.

Absence of deformation on the lateral film should not be taken to indicate that the injury is necessarily a minor one, since the plantar view may show marked fissuring with involvement of the posterior facet. The most obvious roentgen finding in this latter view, in compression fractures, is widening of the bone, due to splitting in the vertical plane.

The author discusses the method he uses to reduce fractures of the calcaneus, usually under fluoroscopic control. This usually results in good position of the various articular surfaces of the calcaneus and relationship with the adjacent bones. After a period of plaster immobilization, the patient is able to walk without difficulty and without disability.

The detail presented in this article is too great for abstracting. A reading in the original is well worth the effort of anyone dealing with this type of injury.

Twenty-eight roentgenograms.

JOHN B. MCANENY, M.D.
Johnstown, Penna.

GYNECOLOGY AND OBSTETRICS

Use of Radiographs in Assessing Disproportion. J. Chassar Moir. Brit. M. J. **2:** 1437–1440, Dec. 24, 1949.

The complexity of forces involved in childbirth causes some obstetricians to distrust the role cephalopelvimetry plays in foretelling dystocia. Such factors as the force and frequency of uterine contractions, the adaptability of soft tissues, the moldability of the head, and even the patient's temperament are important in determining dystocia. Nevertheless, cephalo-pelvic disproportion is the major cause of dystocia, and it is here that radiography is of help.

Pelvimetry permits accurate measurement of the diameters of the pelvis at its various levels. The pelvic shape, an important influence in the mechanism of labor, is determinable. Some estimation of fetal head size may be made. By intrapartum radiography the progress of labor can be observed. During trial labor it will show whether the greatest head diameter has passed the narrowest part of the pelvis.

The methods of assessing disproportion are reviewed, including reference to the three standard charts devised by the author (see Absts. in Radiology **49:** 650, 1947; **54:** 468, 1950) for the pelvic brim, for the pelvis at the level of the ischial spines, and for the outlet, from which an impression can be gained as to the level at which difficulty may be expected with different sizes of the fetal head.

An analysis of 193 cases clinically suspected of pelvic abnormality gave the following results: Of those in which easy delivery was forecast on the basis of the charts, 72 per cent gave no difficulty. When difficult delivery was forecast 86 per cent had prolonged labor or required operative interference. It was felt that the incidence of cesarean section was reduced as a result of radiographic studies rather than increased. Occasionally a clinically contracted pelvis was found upon roentgenographic studies to be associated with a small head, and a trial of labor was permitted. At times the roentgenograms revealed grave difficulty where none was suspected clinically.

Radiography permitted much quicker and more confident separation of the very easy cases from the difficult ones than was possible by clinical means alone.

Three charts. MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Growth of the Foetal Biparietal Diameter During the Last Four Weeks of Pregnancy. Sydney Josephs. (With Statistics by H. Campbell.) Brit. M. J. **2:** 1440–1443, Dec. 24, 1949.

Two hundred and twenty-three radiologic estimations of intra-uterine fetal biparietal diameters were performed on 189 patients and compared with caliper measurements obtained on the third day after birth. In 75 per cent of all cases the prediction was found to be correct within 2.54 mm., and in 95 per cent within 3.8 mm. These results are of a much higher degree of accuracy than is usually obtained. Unfortunately the author does not give his method.

In 34 cases cephalometry was done twice. There was no sign of biparietal growth between the thirty-sixth and fortieth weeks of pregnancy.

The results reported here are startling and require confirmation before universal acceptance.

Four roentgenograms; 1 chart; 4 tables.

MORTIMER R. CAMIEL, M.D.
Brooklyn, N. Y.

Roentgen Demonstration of Fetal Death (Gas Within the Fetus) and Uterine Rupture. A Report of Three Unusual Cases. Charles N. Davidson. Am. J. Roentgenol. **62:** 837–842, December 1949.

The author reports three obstetrical cases showing evidence of gas in the fetal circulatory system. One case was associated with uterine rupture; in one, death was attributed to syphilis; in the third, there was puerperal sepsis with gas in the uterus, due to a gas-forming organism.

Attention was first called to roentgen demonstration of gas in the fetal circulatory system by Roberts (Am. J. Roentgenol. **51:** 631, 1944), who contributed this as a new sign of fetal death. He found no definite cause for the gas, and none was apparent in the first two cases recorded in the present paper.

The author lists the roentgen findings in uterine rupture, as manifested in his case, as follows: (1) the presence of a well defined mass in the abdominal cavity; (2) fetus outside the confines of this mass; (3) absence of uterine wall circumscribing the fetus; (4) unusual position of the fetus.

Eight roentgenograms.

WILLIAM H. ROBINSON, M.D.
Cleveland Clinic Foundation

THE GENITO-URINARY SYSTEM

Renal Injuries. James C. Sargent and Charles R. Marquardt. J. Urol. **63:** 1–8, January 1950.

This paper is a survey of 200 cases of renal injury, which are divided into three groups according to the extent of the trauma. These are given in the order of frequency.

1. Contusion or minor parenchymal fracture with some pain, brief gross hematuria, and usually negative x-ray findings, although occasionally non-function may be demonstrated by the excretory urogram. This type of lesion will heal spontaneously and is managed conservatively.

2. Major parenchymal fracture with gross hematuria lasting several to many days, with soft-tissue shadows of perirenal hematoma, pyelographic evidence of fracture, or both. This group is also managed conservatively for the major part. In less than 3 per cent complications necessitating surgical intervention will develop, such as perinephric abscess, large cyst formation impairing renal function, or functionless kidney.

3. Severe shattering of the kidney with total loss of the normal pyelographic architecture and massive perirenal hemorrhage. Death frequently occurs before anything can be done, but those patients who survive

are treated by nephrectomy, providing there is no evidence of shock.

Seven roentgenograms; 1 drawing.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Evaluation of the Merits of Cystoscopy and Retrograde Pyelography in the Management of Renal Trauma. Lazarus A. Orkin. J. Urol. **63:** 9–24, January 1950.

The following points summarize this article, which is based upon a series of 37 cases of renal trauma:

1. Just as diagnosis is essential in determining therapy, so also is pyelography essential in establishing the diagnosis.

2. Retrograde pyelograms proved far superior to excretory urograms, leading to the correct diagnosis in every instance, whereas the excretory studies were diagnostic in only 28 per cent of the cases studied.

3. Retrograde studies were of chief importance in revealing extravasation, which in the author's opinion must be remedied surgically.

4. Excretory urograms were of value in showing the presence and configuration of the normal kidney, but were disappointing and also misleading in assessing the extent of renal damage. Normal findings were noted when renal trauma existed, and non-function was occasionally present when the trauma was not severe. Furthermore, in a large number of instances, the urograms were unsatisfactory for diagnosis.

5. Cystoscopy is of aid, since it may demonstrate the bladder to be the source of bleeding, as from a tumor.

6. Management was preferably by surgery when there was evidence of extravasation, perinephric abscess, traumatic cyst, or contracted, non-functioning kidney.

The conclusions are: Retrograde pyelograms should be done on all cases of renal trauma except in the very ill or in the presence of severe associated lesions. Surgical intervention is preferred to conservative management when there is rupture of the kidney as shown by extravasation.

Fifteen roentgenograms; 4 tables.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

A Consideration of the Problems Presented by Unilateral Cystic Kidney Disease. Nathaniel Kutzman and Hans R. Sauer. J. Urol. **63:** 34–47, January 1950.

This article discusses simple, pyelogenic, and parapelvic cysts. Other types include polycystic kidney, retention or inflammatory cysts, and cysts secondary to renal pathology. The material consisted of 7 cases of simple cyst, 2 cases of parapelvic cyst, and 1 of pyelogenic cyst, figures which are representative of the relative frequency of the three types.

The etiology is unknown. Pyelogenic cysts probably are embryonal pelvic outgrowths, whereas simple and parapelvic cysts are acquired and probably develop as a result of several factors, one of which may be congenital. A simple cyst is usually single, shows considerable range in volume, and originates from the lower kidney pole in two-thirds of the cases. Simple cysts may be mutilocular. They may also be mutiple, sometimes being so extensive as to simulate unilateral polycystic disease. They tend to grow out from the kidney, thus sparing the epithelium. Hemorrhage commonly occurs into the cyst as the result of trauma, proliferation of the lining, or malignant change. Infection also may develop.

Pyelogenic cysts are outgrowths of the renal pelvis, having the same wall structure and usually connected to the pelvis by a narrow channel, in which case they will contain urine. Stones may form in such cysts. In location they may be within the kidney substance or protrude beyond it.

Parapelvic cysts are usually small and originate from the hilar region. With enlargement, they may produce pelvic obstruction. Anatomically they resemble the simple cyst and may undergo similar changes.

Symptoms are often lacking or confusing. There may be hematuria, renal colic, or dull renal pain, although just as frequently there are nausea, vomiting, altered bowel habits, or a sensation of heaviness in the abdomen. The diagnosis may be suggested by the presence of a smooth, rounded, movable cystic mass in either side of the abdomen, but since symptoms and findings are frequently absent, it may not be established until surgery or postmortem examination is done.

X-ray findings supply the best evidence of renal cysts. The cyst outline, especially if calcified, and the abnormal renal contour may be demonstrated on the flat plate of the abdomen. Pyelography may be negative or may show changes indistinguishable from neoplasm. Simple cysts may produce deformities in the configuration of the pelvis or calyces; larger ones may displace adjacent organs or the upper ureter, or shift the kidney axis. Pyelography usually identifies pyelogenic cysts by showing the channel connecting cyst and pelvis. Parapelvic cysts are hilar in location and frequently move the kidney from its usual position.

Surgery is frequently necessary to make an exact diagnosis. The treatment is conservative surgery unless there is coexistent carcinoma in the kidney, or the cyst shows malignant change.

Ten roentgenograms; 2 photographs.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

An Unusual Retrograde Pyelogram in Carcinoma of the Kidney: Case Report. William H. Fisher, Jr., James A. Crilly, and Howard B. Mays. J. Urol. **63:** 97–99, January 1950.

This is the report of a case of adenocarcinoma of the kidney in which excretory urograms were reported normal, while the retrograde study showed a filling defect of unusual appearance. The outer portion of the middle calyx was constantly deformed, with the dye in this area forming a peripheral margin or rim outlining a radiolucent mass that seemed to extend outward from the mid region of the pelvis. At surgery this radiolucent mass was found to be the extension of the adenocarcinoma from the parenchyma into the pelvis and the middle calyx, causing dilatation and deformity of the latter structure.

Three illustrations, including 1 roentgenogram.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

A Spindle-Cell Sarcoma of the Kidney, Sixteen Years after Thorotrast Pyelography. Hans U. Zollinger. Schweiz. med. Wchnschr. **79:** 1266–1268, Dec. 31, 1949. (In German)

In 1933 a 48-year-old man was subjected to pyelography with 30 c.c. of thorotrast, with demonstration of an

extreme hydronephrosis. Nephrectomy was refused. In 1949 the patient returned with extreme pain in the left flank. Extensive densities were demonstrable roentgenographically in the left kidney, and it was removed. It was grossly enlarged, and on section the densities were proved to represent retained thorotrast, while an adjacent tumor was found to be a spindle-cell sarcoma, presumably due to the irradiation of the kidney by the thorotrast.

The author advises that thorotrast be abandoned as a diagnostic agent and briefly reviews other cases of late damage resulting from this agent.

Five illustrations, including 1 roentgenogram.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Sarcoma of the Urinary Bladder in Children, with a Review of the Literature. George W. Henry. Am. J. Roentgenol. **62:** 843–854, December 1949.

Sarcoma of the bladder in children under the age of ten is rare. The author reports 2 cases and reviews 89 cases gathered from the literature. The lesions are more prevalent under the age of five and in boys.

Early symptoms are usually those of genito-urinary infection. Cystographic studies will usually demonstrate the presence of a tumor, but cystoscopy and biopsy are necessary for final diagnosis. Cystography with air instillation followed by contrast medium has been found most satisfactory. When a contrast medium is used, the neoplasm causes a filling defect, usually basal in location and often multiple. With air and profile views the tumor may frequently be directly visualized. Localized or generalized irregularity of the walls plus a small bladder capacity implies infiltration of the entire bladder. The lesion rarely metastasizes but invades by direct extension and consistently recurs. Death usually occurs within six months.

Most of the tumors are radiosensitive, but the rhabdomyomxyosarcoma and spindle-cell sarcomas are resistant. Recommendations for therapy are as follows: (1) In the uncommon fundal cases, wide excision of the lesion with multiple biopsies of the remainder of the bladder followed by deep roentgen therapy should be done.

(2) In the typical cases of trigonal sarcoma with obstruction, deep roentgen therapy should be given first, with antibiotics and bladder drainage. If there is satisfactory response then cystectomy should follow.

Six roentgenograms; 3 photomicrographs; 3 tables.

C. WHITSETT, M.D.
Cleveland Clinic Foundation

Retro Caval Ureter: A Case Report. Clinton S. Lyter and Willard C. Meyer. Urol. & Cutan. Rev. **53:** 718–720, December 1949.

A case of retrocaval ureter in an 18-year-old boy is reported. It was recognized preoperatively by the characteristic course of the ureter. An operative approach through a flank incision provided excellent exposure of the upper ureter and kidney. The ureter was divided proximal to the vena cava and, after removal of the distal portion of the ureter from the retrocaval position, an anastomosis was made. A second operation was necessary to relieve ureteral torsion and obstruction caused by adherence of the ureter to the ventral surface of the vena cava at the suture line. The patient was well four months after the initial operation.

According to the author, this is the fifth case of retrocaval ureter to be diagnosed by pyelography and the tenth to be treated by conservative surgery. For a review of the literature, the reader is referred to Creevy's article (J. Urol. **60:** 26–30, July 1948. Abst. in Radiology **52:** 901, June 1949).

Four pyelograms.

Aneurysm of the Renal Artery. Milton I. Schwalbe. J. Urol. **63:** 74–78, January 1950.

The author reports a case of calcified aneurysm of the renal artery which resembled a large atypical renal calculus or a calcification of unknown origin in the region of the right kidney pelvis. It did not have the tortuous or serpiginous contour of an aneurysm, nor did it show parallel calcified lines bordering the radiolucent lumen of the artery, as is usual.

The anatomic diagnosis was established following death from "massive abdominal apoplexy due to rupture of the liver capsule." A postmortem pyelogram shows a bizarre pattern due to extension of calcification into the smaller ramifications of the superior branch of the renal artery.

Five roentgenograms.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

THE BLOOD VESSELS

(See also under The Head and Neck; The Chest)

Radiologic Methods for Studying the Circulatory System and Their Indications. Martins da Silva. Gaz. méd. Portuguesa **3:** 193–206, 1950. (In Portuguese)

This paper is a review of the various radiologic methods for studying the circulatory system and their indications. Though it includes numerous references to the literature, no bibliography is provided.

Angiocardiography. Philip G. Keil, Chris A. Voelker, and Donald J. Schissel. J. Iowa State M. Soc. **39:** 553–556, December 1949.

A brief summary of the technic, indications, contraindications, reactions and results of angiocardiography is presented, with a few illustrations of the various lesions which can be demonstrated. Pulmonary arteriography and aortography are also discussed, with illustrations of 2 cases of lung cancer showing vascular obstruction by the tumors.

The article can be recommended to anyone wishing a quick review of the subject.

Six roentgenograms. ZAC F. ENDRESS, M.D.
Pontiac, Mich.

A Study of the Collateral Circulation After Excision of Arteriovenous Fistulas. Lewis H. Bosher, Jr., Fleming Harper, and I. A. Bigger. Surgery **26:** 918–926, December 1949.

The occurrence of chronic vascular insufficiency after excision of an arteriovenous fistula has been observed for several years, and it has been suggested that this could be explained by a regression of the arterial collateral bed. The authors report studies made to determine whether or not such a regression of the collateral bed could be demonstrated in experimental animals following fistulectomy.

Young adult dogs were used as experimental animals,

and arteriograms were made of the lower extremities, using one leg of each animal as a control. A marked contraction of the collateral bed was demonstrated as early as four days after fistulectomy. In the majority of the animals the collateral bed regressed to a level approximately equivalent to or only slightly greater than that produced by simple ligation of the artery.

Six illustrations, including 4 arteriograms.

J. B. SCRUGGS, M.D.
University of Arkansas

TECHNIC

Axial Transverse Stratigraphy. N. Macarini and L. Oliva. J. belge de radiol. **32:** 187–213, December 1949. (In French)

In 1947, Vallebona described the first practical new method of stratigraphy, axial transverse stratigraphy. In this method the vertically placed patient is rotated in the same direction as the horizontally placed film. The roentgen tube is fixed, and the incidence of the ray on the film is strongly oblique. The shadows of the layers above and below the desired layer to be examined are eliminated not only by stratigraphic effect but principally by their projection beyond the confines of the sensitive film. Thus, this method permits radiologic exploration in the third dimension. It is useful in demonstrating the relationship of tuberculous cavities, abscess cavities, cysts, etc., to the mediastinum, thoracic wall, and pleural surfaces.

Twenty-seven illustrations, including 25 roentgenograms.

[Professor Vallebona has described this technic in Radiology **55:** 271, August 1950.—ED.]

CHARLES NICE, M.D.
University of Minnesota

ECONOMIC ASPECTS

Trends Affecting the Welfare of Radiology. Ramsay Spillman. New York State J. Med. **49:** 2805–2807, Dec. 1, 1949.

The trends which the author discusses are of an economic nature and partly political. He is concerned for young men starting in radiology, facing large expenditures to open offices, because the high taxes paid by the men in old established offices preclude their hiring assistants. A few turn to the Veterans Administration and the armed forces, but he fears the rest are forming a group susceptible to exploitation by the hospitals (salary arrangements, Blue Cross "paying" for x-ray examinations, etc.).

He then discusses the possible effects of socialization of medicine, the enormous increase in work with consequent cheapening of quality. He also passes on a word of criticism to his own referring doctors for sending cases to him which could have been diagnosed without the aid of x-rays.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

RADIOTHERAPY

Radiotherapy of Cancer of the Cervix Uteri. Results of Transvaginal Roentgen Therapy. Juan A. del Regato. Prensa méd. argent. **36:** 2747–2755, Dec. 30, 1949. (In Spanish)

The advent of shock-proof apparatus has brought about improvements in the technic of transvaginal irradiation. The author declares that in the majority of cases of cervical epithelioma the most important part of the treatment is adequate external irradiation, but since this rarely suffices to sterilize the tumor, it must be supplemented by internal irradiation. The external irradiation diminishes secondary infection and inflammation and reduces the physical dimensions of the tumor and this in turn makes possible total destruction of the residual tumor by means of internal irradiation. Radium applied internally in the vagina and uterine cavity causes sterilization of a considerable proportion of these neoplasms, depending upon the thoroughness of the external irradiation and the correctness of the technic in the application of radium.

Transvaginal roentgen therapy can be utilized to replace only the vaginal application of radium, retaining the practice of intrauterine radium treatment. The author has devised a special speculum to which the ordinary x-ray equipment may be attached. Treatment at 200 kv. is considered adequate. The article presents the technic in detail and concludes that transvaginal roentgen therapy is a method of great utility as a complement to external irradiation in these cases. Thirty-three per cent of the patients thus treated have survived for five years without signs of recurrence or metastasis.

Seven illustrations.

JAMES T. CASE, M.D.
Chicago, Ill.

Epidermoid Carcinoma of the Anus and Rectum. Review of 125 Cases. George E. Binkley. Am. J. Surg. **79:** 90–93, January 1950.

The author presents a brief analysis of the clinical aspects and treatment of 125 cases of epidermoid carcinoma of the anus and rectum. Five-year follow-up was available on 74 of these cases.

These neoplasms comprise about 3.6 per cent of cancers of the anus and rectum. They are more common in females and about 15 per cent of the patients in this series were colored. Venereal disease is often a coincident finding.

The rarity of the correct diagnosis is suggested by the fact that, though 36 patients had received treatment prior to being seen in the clinic, in only 4 had a diagnosis of cancer been made. The symptoms fall into four main groups: (1) bleeding, (2) pain, (3) change in bowel habit, (4) miscellaneous complaints, such as flatulence, tenesmus, sensation of a rectal mass, etc. Routine rectal examinations with biopsy and routine study of surgical material are strongly urged.

Epidermoid carcinomas may arise above or below the mucocutaneous line of the anus. Below the mucocutaneous border they may appear as skin cancers in the perianal area, as fissures, or on the surface of hemorrhoids. Above this site, they closely resemble early adenocarcinomas.

Spread of these tumors is determined largely by position. Below the mucocutaneous line, dissemination is usually to the inguinal nodes; cephalad to this site, lateral and upward spread into the pelvic soft tissues and liver is encountered.

The location and extent of disease are the principal factors in selection of radiation or surgery for treatment.

Currently, small lesions below the mucocutaneous line receive radiation alone or radiation followed by local excision. Large lesions in this area are given moderate preoperative radiation and wide perineal resection. If inguinal lymphadenopathy is present, groin dissection is also done. Above the mucocutaneous line, preoperative radiation and a wide one-stage abdomino-perineal resection are favored. More extensive pelvic resections, including inguinal dissection, are done in the very advanced cases. Prophylactic inguinal node dissection is never performed. The inoperable group is treated by radiation with a multiple portal technic plus colostomy where necessary.

The five-year follow-up in the author's clinic revealed a 29 per cent survival for the total group and a 41 per cent survival for the operable cases. This compares with figures ranging from 28.5 to 41.5 per cent cited by other authors.

N. F. ZIMMERMAN, M.D.
University of Pennsylvania

Anorectal Malignant Melanoma. Ronald W. Raven. Am. J. Surg. **79:** 85–89, January 1950.

The author opens his paper with a discussion of melanoma in general, mentioning the high incidence in animals and hybrid fish, and describing the type cell, the melanoblast. He points out also the high metastasizing potential of malignant melanomas, for which he holds two main factors responsible: (1) The malignant melanoblast is an individual unit possessing a marked degree of cell autonomy. (2) Melanoblasts tend to be separated from the main tumor and be carried away in the blood or lymph stream to other localities.

The commonest sites of malignant melanoma are the lower extremity, head, neck, face, and trunk. The alimentary canal is seldom involved; when it is, the tumor is usually in the anorectal region.

Anorectal melanomas arise in the skin of the anal canal. Usually a single tumor, varying in size from a miliary nodule to a large mass is found. Satellite tumors may develop, and amelanotic varieties are described. The spread of the tumor is by three methods: (1) direct extension along submucous tissues to rectum; (2) lymphatic spread to ileoinguinal nodes; (3) hematogenous spread, which may be delayed a number of years. A common symptom is a protruding mass at the anal orifice. It may be brown or black and ulcerated. Melena is frequent.

In spite of the fact that end-results are disappointing, whatever the surgical approach, the author believes that radical excision will salvage some patients. He advises an exploratory laparotomy first, to investigate extensions of the tumor, and, under favorable conditions, abdominal-perineal excision of the rectum followed in one month by a bilateral ileo-inguinal block dissection.

The fact is brought out that direct radiation effect on the tumor cells is minimal with the usual dosages. Since all stroma has been replaced by malignant tissue, there is no stromal reaction. Irradiation, therefore, should not be used unless the lesion is inoperable.

Eight illustrations.

JACK EDEIKEN, M.D.
University of Pennsylvania

Malignant Lymphoma: A Clinico-Pathologic-Radiotherapeutic Classification. P. F. Sahyoun, S. J. Eisenberg, and F. B. Mandeville. Virginia M. Monthly **76:** 620–628, December 1949.

The authors compare their classification of the lymphomas with that of Gall and Mallory (Am. J. Path. **18:** 381, 1942) as follows:

Gall and Mallory Classification	Proposed Classification
Stem-cell lymphoma	Stem-cell sarcoma
Clasmatocytic lymphoma	Clasmatocytoma
Lymphoblastic lymphoma	Reticulum-cell sarcoma
Lymphocytic lymphoma	Lymphosarcoma with blood invasion or leukosarcoma.
	Lymphosarcoma without blood invasion.
Hodgkin's lymphoma	Hodgkin's disease
	(*a*) Compactly cellular
	(*b*) Fibrogranulomatous
	(*c*) Loosely cellular—acute.
Hodgkin's sarcoma	Hodgkin's sarcoma
Follicular lymphoma	Giant follicular lymphoma

The clinical resemblance of the *stem-cell sarcoma* to all the more malignant members of the lymphoma group is marked. The immediate response to irradiation is usually good, with rapid reduction of tumor size, but recurrence or development of new tumors follows in one to five months. All the authors' patients died within a year.

Clasmatocytoma shows a clinical picture resembling that of stem-cell sarcoma and the response to irradiation is similar.

In *reticulum-cell sarcoma*, the general aspect is one of somewhat less rapidly progressive malignancy than in the two preceding types. From the authors' limited number of cases it appears that those tumors which present a more malignant picture histologically respond to irradiation like the stem-cell sarcomas, while a more favorable response and better control are to be expected from those with a more orderly and less malignant appearance.

The general clinical picture of *leukosarcoma and lymphosarcoma* resembles that of reticulum-cell sarcoma with apparently less pain and tenderness of the involved nodes. The liver and spleen are more commonly palpable in lymphosarcoma than in the types previously described. All 6 of the authors' patients who received adequate x-ray therapy showed some node regression. The course, however, is rapid in cases with abundant mitoses and blood invasion. It may be prolonged to twenty to thirty-six months when mitoses are few and there is no invasion of the blood stream.

Hodgkin's disease is only briefly discussed. The nodes were found to regress markedly with roentgen irradiation, but recurred after six weeks, and later therapy was less effective.

Only 2 proved cases of *giant follicular lymphoma* were seen by the authors, neither of which is considered illustrative of this more slowly progressive lymphoma.

Six photomicrographs.

S. F. THOMAS, M.D.
Palo Alto, Calif.

Management of Chronic Regional Ileitis. Everett D. Kiefer, Samuel F. Marshall, and M. P. Brolsma. Gastroenterology **14:** 118–126, January 1950.

This paper presents a critical evaluation of the pres-

ent-day management of chronic regional ileitis. Special attention is given to the problems associated with recurrence after surgical treatment. The study is based on experience with 33 patients treated medically and 126 treated surgically. Fourteen of the latter group are also included in the medically treated group.

Medical management is suggested as the treatment of choice (1) where there is localized disease of short duration and without complications, such as obstruction, fistula, or abscess; (2) where there is uncomplicated but widespread disease involving so much of the small intestine that extirpation of all of the affected portion would seriously impair absorption. Surgical resection is indicated (1) for all cases complicated by obstruction, fistulas, abscesses, and granulomatous masses; (2) for those cases which prove to be intractable on a medical regimen.

The recurrence of the disease in one third of the resected cases indicates that surgery alone is inadequate and that additional measures are necessary. It is recommended that a prolonged postoperative period of medical management, including the newer antibiotics, and a rest cure of six months or longer might reduce the incidence of clinical recurrences. If medical treatment does not control or arrest the disease, further surgical resection is indicated. Surgery is also indicated in cases of recurrent obstruction, fistula or abscess formation and in cases in which the x-ray evidence indicates that the recurrent process is well localized. In cases of widespread involvement and cases showing evidence of some impairment of absorption, surgery should be undertaken only as a last resort, and with the knowledge that serious nutritional disability may follow further removal of diseased intestine. The authors state that the total resected small intestine should not exceed 72 inches as estimated by the surgeon before removal.

X-ray therapy was given to 7 patients. The series is so small, however, that an adequate evaluation of results could not be made.

NORMAN GLAZER, M.D.
Cleveland City Hospital

The Acne Problem. Harry M. Robinson. South. M. J. **42:** 1050–1059, December 1949.

A study of the histories, progress, and clinical course of 2,083 cases of acne vulgaris has been made by the author. Of the 2,083 patients, 130 were fifteen years of age or younger, and 3 of these had already received from other physicians what is generally accepted as a full "acne" course of x-ray irradiation.

The author administered a course of x-ray therapy to 252 patients; 16 of these had poor results, with lesions occurring throughout the course and present at the final treatment. In 236 the results were satisfactory. The author withholds roentgen therapy until patients reach the age of eighteen or over.

Many theories have been advanced regarding the cause or causes of acne, and while some of these factors or agents seem plausible, none has been proved to be the unquestionable primary factor, the control of which will cure the disease.

The author uses the following grouping as a working basis for treatment:

1. Patients with a mild type of acne.
2. Patients up to age of 17.
3. Patients from the age of 17 to 19.
4. Patients who fear the effects of roentgen therapy.
5. Patients who have already received their full quota of roentgen therapy for this condition and on the sites of the present eruption.
6. Patients with exacerbation of lesions occurring only at the menstrual periods.
7. Patients under treatment for pulmonary tuberculosis.
8. Those patients over 19 in whom there is no contraindication to irradiation or elimination diets.

Irradiation is used as indicated in groups 3, 7, and 8, with or without other measures.

No one routine method of treatment is applicable in all cases of acne vulgaris. The author feels that his results, showing benefit in about 92 per cent of the cases, justify the classification given above. In view of the many contributing factors cited, control or elimination of one or more of these should at least be attempted.

ROBERT H. LEAMING, M.D.
Jefferson Medical College

Radium Therapy in Partial Hearing Loss. Norton Canfield and David Sudarsky. Ann. Otol., Rhin. & Laryng. **58:** 957–975, December 1949.

The paper deals with partial hearing loss associated with hyperplasia of the nasopharyngeal lymphoid tissue. The irradiation of the pharyngeal ostia of the eustachian tubes was originally undertaken by Crowe in an effort to relieve partial or complete obstruction of the tubes by lymphoid tissue. This therapy was based on the theory that partial or complete tubal obstruction was related to some degree of hearing loss. Two of Crowe's original tenets were that this type of obstruction was a common etiological agent in the production of the partial hearing loss of many children and that continued obstruction might cause permanent hearing disability.

The authors analyze the results of radium therapy in a selected group of 50 children with partial hearing loss at the New Haven Hospital. In every case treated, a follow-up audiogram was obtained. The technic is described.

As early as six weeks after a course of radium treatments one may be able to detect changes in the nasopharyngeal lymphoid tissue marked by atrophy. Usually such changes are evident by the end of the second month after the last treatment. There is quite often a subjective improvement in the patient's symptoms. How long these changes persist is unknown.

Improvement was found by audiometric examination in 56 per cent of the children in the present series. It was noted that the longer the duration of the partial hearing loss, the poorer is the chance for improvement. Also, the percentage improvement was greater in those patients who had received a relatively larger dose of irradiation. There have been no complications of radium therapy reported, probably because the dosage was small.

One photomicrograph; 3 drawings; 9 tables.

DANIEL WILNER, M.D.
Atlantic City, N. J.

RADIOISOTOPES

Radioactive Phosphorus as an Indicator of the Rate of Phospholipide Formation in Patients with Liver Disease. David Cayer and W. E. Cornatzer. Gastroenterology **14:** 1–10, January 1950.

Studies of experimentally produced liver disease in animals have demonstrated that a pathologic picture similar to that of portal cirrhosis in human beings may be produced by various means. In certain instances, the use of lipotropic factors, as methionine and choline, has proved to be of prophylactic and therapeutic value. This beneficial effect is attributed largely to stimulation of phospholipid formation.

In order to test the clinical efficacy of lipotropic agents in certain liver diseases in man, the authors used radiophosphorus as an indicator. Since the liver rapidly incorporates inorganic phosphate into the phospholipids, and since this organ is the main, if not the sole, source of the phospholipids in plasma, it was believed that the rate of formation of phospholipids in the liver would be reflected in the plasma. Accordingly, after injection of radiophosphorus, the radioactivity of the plasma lipids was determined. Eleven patients with clinical evidence of advanced portal cirrhosis and 10 normal controls were studied. All patients were given an intramuscular injection of radiophosphorus in the form of Na_2HPO_4. Blood samples were taken routinely at zero and twenty-four hours, and often at the sixth, forty-eighth and ninety-sixth hour.

In normal persons, the rate of phospolipid turnover measured after injection of radiophosphorus shows considerable variation between individuals.

In patients with advanced portal cirrhosis the values for phospholipid turnover fall into the lower range of the normal controls. When the determinations of phospholipid turnover in these patients are repeated after a prolonged period of therapy, no significant differences are noted even though clinical improvement has occurred.

In 2 untreated patients with cirrhosis, an increase in plasma phospholipid turnover was demonstrated following a single large dose of choline or methionine. No such effect was apparent after these patients had prolonged treatment with methionine.

It is suggested that a definite increase in phospholipid turnover following a single large dose of choline or methionine may indicate fatty infiltration of the liver and perhaps provide an indication of the need for treatment with lipotropic substances.

Four tables. HARRY HAUSER, M.D.
Cleveland City Hospital

Uptake of Radioactive Phosphorus by Gastric Carcinoma in the Human. Seymour J. Gray, John Schulman, Jr., and Marlene Falkenheim. Gastroenterology **13:** 501–512, December 1949.

For the purposes of this study, patients about to undergo gastric resections for either cancer or duodenal or gastric ulcer were given 1 microcurie of radioactive phosphorus as KH_2PO_4 intravenously per pound of body weight. Within an hour after removal of the stomach, the mucosa was peeled from the specimen and digested and the sample diluted to a suitable volume.

Results have been expressed as a biological concentration coefficient, as follows:

$$\text{B.C.C.} = \frac{\text{Counts per minute found in sample/millimole}}{\text{Counts per minute injected/gm body weight}} \times 100$$

The biological concentration coefficient is proportional to the phosphorus turnover. The value is a coefficient which has no dimensions and is not additive.

The rate of turnover of total phosphorus by tumor tissue was found to be 48.5 per cent greater than that of non-cancerous mucosa. The B.C.C. of the various regions of the normal stomach was the same for each fraction and there was no significant difference between the non-cancerous mucosa from the cancer-bearing stomach and the mucosa from a stomach that does not bear a cancer.

It was found that the phosphoprotein fraction, chiefly nucleoproteins, which are cell-building blocks, shows the greatest rate of turnover, 126 per cent. However, this does not represent sufficient selective uptake over the normal to permit the localization and detection of tumors by scanning the stomach with a Geiger counter.

It was also noted that there was no difference in the rate of turnover between stomachs with atrophic gastritis and normal mucosa.

One chart; 5 tables. ROBERT A. HAYS, M.D.
Cleveland Clinic Foundation

Radioiodotherapeusis. Robert H. Williams, Beverly T. Towery, Herbert Jaffe, Walter F. Rogers, Jr., and Rene Tagnon. Am. J. Med. **7:** 702–717, December 1949.

The authors treated 111 patients with radioiodine; 106 had thyrotoxicosis; 3 had non-toxic nodular goiter, and 2 had malignant adenoma. Six of those with thyrotoxicosis had received their treatment too recently for adequate consideration; 3 of the others received I^{130} and 97 received I^{131}. In 92 of the 97 patients treated with I^{131} a remission was produced and had persisted at the time of the report. Most of these patients became euthyroid within six months, with an average of approximately three months. An average of 2.2 doses of radioiodine per patient were given; 35 patients required only one dose; 14 received more than 3 doses. In the group experiencing remissions within six months, approximately 225 μc. per gram of thyroid tissue were administered. An average total of about 8 mc. was required for thyrotoxic patients with diffuse hyperplasia of the thyroid and those previously thyroidectomized; 22 patients with toxic nodular goiter required larger total doses although somewhat smaller in proportion to the size of the thyroid gland.

The goiter was reduced in size in all instances. In most of the patients with diffuse hyperplasia the thyroid became essentially normal or subnormal in size before remission resulted. In 3 patients persistent myxedema developed and in 16 others transient hypothyroidism resulted.

In the 3 patients with thyrotoxicosis who were treated with I^{130} results were excellent.

In the 2 cases of malignant adenoma the cervical masses became impalpable. Three subjects with nontoxic nodular goiter experienced only slight reduction in the size of the goiters.

No significant untoward effects from the radioiodine were manifested by non-thyroid tissues. One patient was pregnant at the time of her therapy, one had acute glomerular nephritis, one had chronic pyelonephritis, 3 had had acute hepatitis, and several had congestive heart failure.

Ten illustrations; 12 tables.

Factors Influencing the Effectiveness of Radioiodotherapeusis. Robert H. Williams, Herbert Jaffe, Beverly T. Towery, Walter F. Rogers, Jr., and Rene Tagnon. Am. J. Med. **7:** 718–730, December 1949.

In treating thyrotoxicosis with radioiodine, some of the problems are similar to those encountered with surgical therapy. The effectiveness of radioiodine, like that of subtotal thyroidectomy, depends upon the elimination of the majority of thyroid acinar cells. Since only slight differences in the quantity and quality of tissue remaining may determine whether the amount of thyroid hormone produced is excessive, adequate, or inadequate, it is imperative that this problem be evaluated carefully.

In the authors' experience with radioiodine in the treatment of patients with thyrotoxicosis (see preceding abstract) the quantity of isotope required to produce remission varied considerably. In investigating technics that might be used as indicators of the amount of isotope needed, an attempt was made to correlate the dosage with (1) earlier estimations of amounts of radioiodine in blood, urine, or thyroid region at specific intervals after test doses and (2) clinical examination of the thyroid gland.

None of the methods was very satisfactory. Clinical evaluation of the thyroid gland was of moderate aid. Nodular goiters required larger total amounts of isotope than diffuse goiters but less per gram of thyroid. Patients previously treated with thiouracils for long intervals or by thyroidectomy did not show statistically significant differences in the quantity of radioiodine needed, except in so far as the quantity of thyroid tissue present was affected.

The value of the administration for short intervals of propylthiouracil before, and of potassium iodide after, radioiodotherapeusis is discussed, along with many other factors affecting the results of therapy.

Ten illustrations.

Radioactive Iodine, I^{131}, in the Treatment of Hyperthyroidism. Sidney C. Werner, Edith H. Quimby, and Charlotte Schmidt. Am. J. Med. **7:** 731–740, December 1949.

During the past three years, 103 patients have been treated for toxic goiter with radioactive iodine, I^{131}, at the Presbyterian Hospital, New York. When the work was started, information concerning dosage was scant, and the first patients were treated more or less empirically. By January 1948, the accumulated data indicated that about 50 to 100 μc. I^{131} retained per estimated gram of thyroid tissue resulted in satisfactory remission in a high percentage of cases. Since the average retention of I^{131} after ingestion is about 50 per cent of the administered amount, the administration of approximately 100 to 200 μc. per estimated gram of gland weight would approach the desired goal. A total dosage of about 3 to 15 mc. would thus be required. However, for fear of inducing a high incidence of hypothyroidism, it was decided to limit the highest dosage to 6.5 mc. and to retain the lower limit at 3 mc. Larger glands accordingly received somewhat less than the desired amount of I^{131} per gram of gland tissue and smaller ones somewhat more. Those patients failing to show remission within four months on such dosage were retreated. A final third dose was given to the few patients who remained uncontrolled four months later. (All doses herein are in terms of the New York millicurie, which is about 1.4 times as great as the millicurie used at Oak Ridge until July 1, 1949, and is within 10 per cent of the unit now in use there.)

The method of therapy used and the calculation of radiation are outlined. The results are analyzed in terms of number of treatments, total dosage per treatment, dosage per estimated gram of thyroid tissue, and radiation received by the gland. About 92 per cent of all the patients were relieved of hyperthyroidism (about 97 per cent of those treated more recently).

Since the question of possible malignant change following radioiodine therapy remains unsettled, it is believed that its use in primary previously unoperated goiter should be restricted in general to the older age groups. In treating recurrent toxic goiter, however, when hyperthyroidism has reappeared after surgery, I^{131} is the method of choice.

The important complications affecting I^{131} therapy are discussed.

Two graphs; 7 tables.

Distribution of Radioiodine in a Patient with Metastatic Adenocarcinoma of the Thyroid. Report of a Case. Joseph E. Rall, F. Raymond Keating, Jr., Marschelle H. Power, and Warren A. Bennett. J. Clin. Endocrinol. **9:** 1379–1391, December 1949.

Clinical and necropsy data on a 55-year-old man with adenocarcinoma, grade 4, of the thyroid gland, treated with 63 millicuries of radioiodine, are reported. The distribution of radioiodine in the various tissues and organs was determined and used as a basis for estimating the quantity of radiation received. Except for the thyroid gland and one metastatic growth, the amount of radiation appeared negligible. Marked disparity was observed in the accumulation of iodine in the primary tumor and various metastatic growths. This could be correlated to some extent with differing degrees of histologic differentiation. This study throws some light upon the distribution of radioiodine in tissues other than the thyroid as well as upon the accumulation of radioiodine by primary and metastatic thyroid neoplasms.

Eight figures; 2 tables.

Metabolic Studies with I^{131} Labeled Thyroid Compounds. Comparison of the Distribution and Fate of Radioactive d-l-Thyroxine After Oral and Intravenous Administration in the Human. A. Albert and F. Raymond Keating, Jr. J. Clin. Endocrinol. **9:** 1406–1421, December 1949.

The metabolic behavior of racemic radiothyroxine administered intravenously was studied in a myxedematous patient, maintained at a euthyroid level with racemic non-labeled thyroxine. After one half-life of the thyroxine I^{131}, 41 per cent of the radioactivity was excreted in the urine and 12 per cent in the feces. Eighty-five per cent of the urinary I^{131} was present as inorganic iodide and 15 per cent as organic I^{131}, consisting of both thyroxine and diiodotyrosine. This pattern was essentially like that obtained in a similar study in

which radiothyroxine was administered orally. Various aspects of the kinetic behavior of radiothyroxine are described.

Three charts; 4 tables.

Behavior of Labeled Thyroglobulin and Labeled Thyroxine in Patients with Myxedema. A. Albert, Joseph Edward Rall, F. Raymond Keating, Jr., Marschelle H. Power, and Marvin M. D. Williams. J. Clin. Endocrinol. **9:** 1392–1405, December 1949.

Comparative studies with labeled inorganic iodide in 2 myxedematous patients were made during hypothyroid and euthyroid states. During myxedema, there was localization of radioiodide only in residual thyroid tissue. At a normal metabolic level, no thyroidal accumulation occurred. A small proportion of the labeled iodide appeared in the precipitable fraction of serum during myxedema but not during euthyroidism. All of the I^{131} eliminated in the urine appeared in the form of iodide. Two to 4 per cent of the dose was excreted in the feces, all of it being organically bound.

Comparative studies were made with labeled thyroglobulin during hypothyroidism and euthyroidism in a patient with spontaneous myxedema. Temporary localization of radioactivity occurred over the liver. Within an hour, I^{131} appeared in the serum in both precipitable and non-precipitable form. Fifty-eight per cent of the I^{131} appeared in the urine, of which 90 to 95 per cent was in the form of iodide. The remaining urinary I^{131} (5 to 10 per cent) behaved like diiodotyrosine. About 11 per cent of the dose was eliminated in the feces, all of it in precipitable form.

Similar comparative studies with labeled racemic thyroxine disclosed considerable amounts of radioactivity over the region of the liver. Radioactivity in serum was initially entirely in precipitable form, after which inorganic iodide appeared. The urinary excretion was 28 to 48 per cent of the dose and for at least two days after ingestion the curve of urinary excretion was linear in nature. Fifteen per cent of the urinary I^{131} behaved as diiodotyrosine, and 85 per cent behaved as inorganic iodide. Twenty-three to 38 per cent of the dose was found in the feces, the radioactivity being confined exclusively to the precipitable fraction.

Six charts; 6 tables.

Preliminary Communication on the Intracavitary Irradiation of the Bladder Mucosa by Radioactive Isotope Solution. D. M. Wallace, R. J. Walton, and W. K. Sinclair. Brit. J. Urol. **21:** 357–364, December 1949.

In the three months previous to the publication of this report, the authors used a 150 ml. radioactive sodium solution in a balloon to treat lesions involving the bladder mucosa in 10 patients. In 8 of these there was a histologic diagnosis of cancer; in the other 2 the diagnosis was inconclusive, owing to an inadequate biopsy section. In no case was a benign papilloma reported.

In all 10 cases the mucosal lesions showed some evidence of regression. In 7, all evidence of a mucosal neoplastic lesion disappeared. One patient received only symptomatic relief, without cystoscopic confirmation of regression; the treatment was adequate to stop hemorrhage but the lesion remained. In 1944 this patient had been treated for a carcinoma of the bladder by high-voltage therapy.

There was no loss of control in any of the male patients treated; no proctitis nor any bleeding following treatment.

While it is too early to make any claims for this form of therapy, the authors believe the results are sufficiently interesting to persevere with the technic described in order to ascertain the optimum dose and whether fractionated or single dose therapy is the more effective.

Five illustrations, including 1 roentgenogram.

Effect of Splenectomy on the Toxicity of Sr^{89} to the Hematopoietic System of Mice. Leon O. Jacobson, Eric L. Simmons, and Matthew H. Block. J. Lab. & Clin. Med. **34:** 1640–1655, December 1949.

Radiostrontium, Sr^{89}, a beta-ray emitter with a half-life of 55 days, is physiologically interchangeable with calcium and localizes largely in bone, particularly in the areas of active growth.

When mice were given intraperitoneally 2 microcuries of Sr^{89} per gram of body weight, a cellular depletion of bone marrow occurred, producing leukopenia, but no anemia because of the assumption of erythrocytopoietic function by the spleen. This in turn reduced splenic lymphocytopoiesis, which did not return to normal even after four months, and also delayed the appearance of compensatory ectopic granulocytopoiesis in tne spleen for one to two months.

When splenectomized mice were given a similar dose of the isotope, anemia developed, in addition to the leukopenia, because the compensatory erythrocytopoiesis of the spleen was lost and because the other potential sites of this activity were inadequate. These animals also showed minimal ectopic granulocytopoiesis. Within four months the anemia and leukopenia were gone, due to recovery of the bone marrow, but were reinduced by repeating the dose of radiostrontium.

Nine illustrations; 1 table.

CORNELIUS COLANGELO, M.D.
Chicago, Ill.

Effect of Bromobenzene and 3,4-Benzpyrene on the Metabolism of Radioactive L-Cystine. Helmut R. Gutmann and John L. Wood. Cancer Research **10:** 8–12, January 1950.

The effects of bromobenzene and 3,4-benzpyrene on the sulfur metabolism of the rat have been investigated with the aid of L-cystine labeled with radioactive sulfur. Isolation of radioactive bromophenylmercapturic acid from the urine of rats which had received bromobenzene showed that radioactive sulfur administered as L-cystine was utilized for the synthesis of mercapturic acid. About 4 per cent of the labeling sulfur appeared in the mercapturic acid fraction within twenty-four hours after the simultaneous administration of bromobenzene and L-cystine. Less than 10 per cent of the total mercapturic acid excreted in twenty-four hours came from exogenous sulfur.

The administration of 3,4-benzpyrene produced no effect on the sulfur metabolism of cystine which was injected simultaneously with the hydrocarbon. In particular, there was no evidence for the formation of a mercapturic acid resulting from the conjugation of 3,4-benzpyrene with cystine.

Two tables.

EFFECTS OF RADIATION

Herpes Zoster After Irradiation. Frank Ellis and Basil A. Stoll. Brit. M. J. **2:** 1323–1328, Dec. 10, 1949.

The authors review the literature concerning the relationship of herpes zoster to cancer and the reticuloses, and describe 45 cases of zoster developing after irradiation. This series includes 24 cases of carcinoma of the breast, 15 cases of varied malignant diseases, and 6 cases of non-malignant diseases. The maximal incidence of herpes zoster was found to be at the somatic level of the primary lesion and, therefore, at the site of irradiation. The zoster usually appeared in three to six months following the irradiation. There was no evidence of involvement of the posterior nerve roots by the primary lesion. It is felt that the evidence strongly implicates irradiation as an etiologic factor in these cases.

Two illustrations; 4 tables.

ROBERT M. GEIST, JR., M.D.
Cleveland Clinic Foundation

Problem of Radiosensibility of the Peripheral Nervous System. B. Lindemann. Fortschr. a. d. Geb. d. Röntgenstrahlen **71:** 988–993, October 1950. (In German)

After fractionated deep x-ray therapy sensory disturbances are noted in the irradiated skin areas. These changes become manifest as soon as the reaction reaches an erythema stage and may persist for several months. If the tongue lies within the radiation area, taste disturbances are observed. These disturbances cannot always be explained by functional damage to the salivary glands, but are probably due to direct influence on the terminal nerve receptors. The taste buds seem to be most radiosensitive, to be followed by the receptors for touch sensation, and later by those for the sensations of pain and temperature. The author's conclusions are based on 15 cases observed clinically, most of the patients undergoing radiotherapy for carcinoma of the larynx, parotid gland, tonsils, tongue, and mediastinum.

ERNST A. SCHMIDT, M.D.
Denver, Colo.

Lesions of the Eye from Radiant Energy. David G. Cogan. J.A.M.A. **142:** 145–151, Jan. 21, 1950.

There is little doubt that glaucoma may follow sufficient roentgen irradiation of the eye. The glaucoma comes on several weeks after irradiation and usually in those eyes in which uveitis develops.

As might be expected, the cornea (along with the conjunctiva) is selectively affected by the non-penetrating forms of radiation, such as the long infra-red, the ultraviolet, the grenz and beta rays. It is also affected by the penetrating roentgen and gamma rays. The infra-red effects on the cornea are thermal burns. Ultraviolet radiation produces keratitis. The effect of grenz rays and beta or cathode rays is similarly that of superficial keratitis. With voltages as low as 8 kv. for grenz rays and 100 kv. for cathode rays, the effects on the cornea are almost entirely in the epithelium. With voltages as high as 25 kv. for grenz rays (more properly "soft" roentgen rays) or as high as several thousand kilovolts for beta rays (such as are emitted by radium), penetration as much as 1 cm. may be expected, and with sufficient dosage there may be involvement not only of the deeper layers of the cornea but also of the lens. The latent period is longer and the duration is longer than in the case of ultraviolet effects. The latent period is an inverse function of the dose; at threshold or near threshold levels (doses of 1,000 to 2,000 r) the latent period and duration are usually a matter of several weeks.

The effects of roentgen and gamma rays on the cornea have not been studied as systematically as have the effects of the ultraviolet and grenz rays, but it is common knowledge that with sufficient dosage keratitis develops, varying in severity and duration in accordance with the dose. Although studies have not yet been made on factors influencing the latent period, it is known that the keratitis from radiation with 4,000 to 6,000 r (such as is used in the treatment of nasopharyngeal tumors) develops in several weeks. The lesion consists usually of a severe epithelial keratitis, such as occurs with grenz rays, but the deeper layers are often involved, leading to an intractable ulcer.

The lens is peculiarly susceptible to radiant energy. Amounts of certain types of radiation which are without clinical effects elsewhere in the body will produce cataracts. With the type of roentgen rays usually employed in therapy (100 to 200 kv.), the minimal cataractogenic dose is of the order of 500 to 800 r. The common procedure of spacing the treatments (Coutard method) so as to get the maximum number of tumor cells in mitosis and at the same time diminish the side effects in the non-tumor tissues is less effective in protecting the lens than other tissues. The latent period for the development of cataracts following roentgen irradiation is usually of the order of six months to two years but may be as long as eight to twelve years. In general, the greater the dose the shorter the latent period. Cataracts from gamma rays and neutrons are similar to those produced by roentgen rays as regards latent period and structure and likewise occur with doses that produce no other clinically evident abnormality. The threshold dose for radium cataracts is of the order of 1,000 gamma roentgens.

The retina is not affected by either radio waves or diathermy waves. The long infra-red waves cause no damage to the retina because they are absorbed in the anterior portions of the eye, but the short infra-red rays and the visible rays reach the retina and may produce a thermal burn. The ultraviolet wave band has not been shown to produce any organic retinal lesion. Roentgen and gamma rays are relatively ineffective in nervous tissue, and the retina is probably no exception.

Radiation burns of the eye are either permanent or spontaneously reversible. There is no specific form of therapy for any of them. Lesions of the cornea are to be treated symptomatically. Cataracts are to be removed surgically when they are sufficiently mature. The only adequate form of treatment for radiation lesions of the eye is prophylaxis.

One illustration.

DANIEL WILNER, M.D.
Atlantic City, N.J.

Effects of Roentgen Rays on the Inflammatory Cells of the Mouse and Rabbit. William A. Townsend and Berry Campbell. Blood. J. Hematol. **4:** 1346–1356, December 1949.

The authors undertook a series of experiments to determine whether morphologic alterations could be induced by irradiation in inflammatory reactions in mice and rabbits following the injection of an irritant substance in the subcutaneous tissue. The mice received doses ranging from 25 to 1,600 r applied to the whole body at various times preceding and following the induction of the inflammation. Doses for the rabbits ranged from 700 to 1,000 r, and both local and whole body irradiation were given. The dosage and times of irradiation included and extended beyond those used by most earlier investigators.

The cytologic studies were made on tissues removed from the site of inflammation. No acceleration of the inflammatory cycle was observed at any dosage, and no effects of any kind were seen at dosages below 250 r in the mouse and 1,000 r in the rabbit. Interestingly enough, lymphocytes did not show the usual or expected sensitivity to irradiation. The "intermediate polyblast" (a lymphocytic derivative) was found to be the most sensitive of the inflammatory cells. "In our results," say the authors, "there is nothing to correlate with the conclusions of many clinicians that roentgen therapy is of great value in a number of inflammatory conditions."

Ten photomicrographs. S. F. THOMAS, M.D.
Palo Alto, Calif.

Effect of Protein Depletion upon Susceptibility of Rats to Total Body Irradiation. F. Lamont Jennings. Proc. Soc. Exper. Biol. & Med. **72:** 487–491, November 1949.

Some components of diet, particularly the vitamin B series and some of the amino acids, have been reported to alter the response to radiation, but the broader problems of protein, fat, or carbohydrate nutrition have apparently received little attention. Since widespread tissue necrosis is a prominent feature of radiation damage, the author undertook an investigation of the effect of protein, particularly a deficiency of protein, on the response to radiant energy. The present report is an attempt to evaluate the role of protein in radiation damage.

Young adult rats showing a 25 per cent reduction in weight while on a protein-poor diet are known to have little reserve protein and were therefore selected for the study. There is considerable confusion concerning the effect of age and weight on susceptibility to radiation. For this reason two types of control animals were used, one group of the same weight as the test animals and the other of the same age. A total of 141 rats, almost equally divided into the three groups, were used in the experiment. Protein depletion consisted of placing the rats on a low protein diet that was adequate in calories, vitamins, and minerals. The rats were continued on the depletion diet until they had lost 25 per cent of their starting weight. Such a weight loss occurred in about ten weeks.

Total body irradiation was administered to all of the animals, with the following factors: 200 kv., 15 ma., 0.5 mm. copper and 3 mm. bakelite filtration, half-value layer, 1.2 mm. copper. The target to animal distance was 71 cm., and the dose rate 17–18 r per minute. Dosage ranged from 300 to 800 r.

The control animals were maintained on a diet identical with that of the test animals except that it contained 22 per cent protein supplied by casein. The age control rats were placed on this diet after they reached a starting weight of about 200 grams, and were continued on it for a period of time equal to that of depletion for the test animals. At time of radiation, these animals were twenty weeks old and weighed about 280 grams. For the second control group, rats with an initial weight of about 100 grams were fed the 22 per cent protein ration until they had reached a weight of approximately 150 grams. These rats were about eight weeks old when irradiated.

During the thirty-day observation period following irradiation, all of the animals were continued on their pre-irradiation diets.

The results of this experiment showed that the protein-depleted rat is materially more susceptible to the physical injury of penetrating radiation than is the animal on an adequate diet. The LD 50/30 for the protein-depleted rats was approximately 520 r while the LD 50/30 for the controls was in the region of 700 r. The increased susceptibility of the protein-depleted rats becomes even more apparent when one realizes that the dose of total body irradiation that killed 50 per cent of the protein-depleted rats killed less than 2 per cent of the control rats. The slope of the regression line for the protein-depleted animals indicates that these animals are proportionately somewhat more susceptible to lower doses of radiation than the controls.

Age or weight in normally nourished adult rats, in the 150 to 280 gram weight range, was found to have little effect on susceptibility to radiation.

One chart; 1 table.

Use of X-rays to Determine the Mitotic and Intermitotic Time of Various Mouse Tissues. Norman P. Knowlton, Jr., and William R. Widner. Cancer Research **10:** 59–63, January 1950.

It has long been known that, as a general rule, the sensitivity of various normal and malignant tissues to x-ray is proportional to the amount of cell division occurring in the tissue. The number of mitoses seen in a biopsy of a tumor is thus one of the criteria for predicting the probable response of the tumor to irradiation. Since the amount of cell division, or more specifically the mitotic index, is dependent upon the mitotic and intermitotic times, a study was undertaken to determine which of these two factors is responsible for differences in the mitotic index seen in various tissues.

A method of determining the mitotic time of mouse tissues by estimating the effect of x-rays on mitosis is presented. The mitotic time was found to vary about twenty to thirty-six minutes in the seven tissues studied. The normal mitotic index and the mitotic time of these tissues were used to calculate the intermitotic time from the formula:

$$\text{Intermitotic time} = \frac{\text{Mitotic time}}{\text{Mitotic index}}$$

It was concluded that, since the mitotic times were relatively constant as contrasted to the intermitotic times, the differences in the mitotic indices of the various tissues were due primarily to the variations in the inter-

mitotic times. Thus, the mitotic index is inversely proportional to the intermitotic time, and, in general, tissue sensitivity to x-rays increases with decrease in the intermitotic time.

Further studies are planned of the mitotic and intermitotic times of certain mouse and rat tumors with the purpose of detecting differences between normal and malignant cells.

Five charts; 3 tables.

Nature of Radiation Injury to Amphibian Cell Nuclei. William R. Duryee. J. Nat. Cancer Inst. **10:** 735, December 1949.

Ovarian eggs of salamanders and frogs were irradiated with graded doses from 500 to 60,000 r (182–194 kv., 25 ma., no filter, 9.5 to 35 cm. distance, dose rate 450 to 7,600 r/m). Nuclear damage was shown by pyknosis, and at 300 r 98 per cent of small eggs were damaged at ten days. Additional and new criteria of damage were fragmentation of chromosomes, loss of lateral chromomere loops, colloidal changes in the nucleoli, change of the intranuclear spindle substance from sol to gel, and localized cytoplasmic flocculation.

When whole cells were irradiated, the elements showed differing sensitivities, but when the cell components were separated by microdissection, the nuclear elements were markedly radioresistant. Low temperatures (5°C) delayed but could not prevent the appearance of the changes, especially on rewarming; high temperatures (27°C) accelerated the rate of damage production. The effect was localized in the irradiated cell by observing that the changes in the theca cells paralleled the ova changes. Typical changes could be produced in non-irradiated cells or nuclei by microinjection of irradiated cytoplasm, or by exposing the nuclei to a bath of irradiated cytoplasm.

This seems to prove conclusively that the cellular radiation damage is a triple phenomenon, consisting of primary physical or radiochemical changes in the cytoplasm, followed by chemical metabolic processes permitting protoplasmic nuclear toxins to form or accumulate in the cytoplasm, and final transmission of these to the nucleus.

Eighteen photomicrographs; 3 tables.

LEWIS G. JACOBS, M.D.
Oakland, Calif.

Resistance of Sciara (Diptera) to the Mutagenic Effects of Irradiation. Helen V. Crouse. Biol. Bull. **97:** 311–314, December 1949.

As a result of experimental studies over the past twenty years it has been the belief that the chromosomes of the fly *Sciara* are resistant to irradiation, since a low mutation rate was repeatedly obtained. The first clue to the contrary was the discovery of a reciprocal translocation in the salivary gland nuclei of larvae taken from cultures of the "Stop" mutant. The salivary gland chromosomes were then utilized in a cytological analysis of F_1 larvae derived from irradiated sperm or oocytes. Following exposure of sperm to 5,000 r, approximately 25 per cent of the F_1 larvae showed gross chromosomal rearrangements.

Several facts are discussed which may contribute to the apparent resistance of *Sciara* to the mutagenic effects of irradiation: (1) The external appearance of the fly (bristle pattern, pigmentation, etc.) is such that only the most conspicuous changes are likely to be detected. (2) There is a distinct difference between the autosomal and the sex-linked mutations, which suggests that the induced mutation rate in this genus is considerably greater than the detected mutation rate. (3) The presence in the germ cells of large amounts of heterochromatin, in the form of the limited chromosomes, may actually retard the mutation rate. (4) It is conceivable that, as compared with *Drosophila* and *Habrobracon*, the biochemical pathways which are available in *Sciara* result in a more restricted range of phenotypic variability. Experimental and statistical data are presented.

J. D. CALHOUN, M.D.
University of Arkansas

nber 1950

accumu-
these to

M.D.
Calif.

utagenic
ol. Bull.

the past
nosomes
ce a low
first clue
al trans-
ıe taken
salivary
tological
sperm or
5,000 r,
ved gross

ribute to
utagenic
arance of
such that
ly to be
ween the
hich sug-
genus is
tion rate.
nounts of
chromo-
ate. (4)
rosophila
ys which
ted range
statistical
, M.D.
rkansas